# ENERGY SURVEY FOR THE UNITED STATES DISCIPLINARY BARRACKS (USDB)

AT

FORT LEAVENWORTH, KANSAS

**FIELD DATA** 

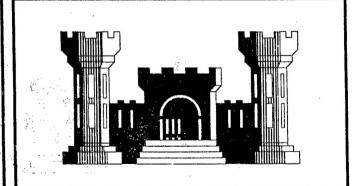
FINAL SUBMITTAL

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ENERGY ENGINEERING ANALYSIS PROGRAM

CONTRACT NUMBER DACA41-89-C-D197

JUNE 25, 1990



KANSAS CITY DISTRICT
CORPS OF ENGINEERS

**EXECUTIVE SUMMARY** 

 $^{\mathsf{C}}\mathsf{R}_\mathsf{B}$ 

#### DEPARTMENT OF THE ARMY

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Marie Wakeffeld,

Librarian Engineering

#### INTRODUCTION

#### A. General Description

The United States Disciplinary Barracks (USDB) is located within the confines of Fort Leavenworth near Leavenworth, Kansas. Fort Leavenworth encompasses approximately 6000 acres of land in which approximately 2000 acres were developed for military use. The USDB is located to the northeast corner of the base.

#### B. Purpose of Report

The purpose of this report is to observe any present energy usage by the USDB and consider opportunities to conserve energy. The report details evaluation of various Energy Conservation Opportunities (ECO) to determine their feasibility.

The report also includes programming or implementation documentation for those ECO's considered feasible. Any ECO having a Savings to Investment Ratio (SIR) greater than one is considered feasible. If the ECO had a SIR greater than one and a simple payback less than 10 years it was considered for Energy Conservation Investment Program (ECIP) funding.

#### C. Observations

During our field trips to the USDB, we noted many observations relating equipment in disrepair. In general, little of the heating, ventilating, and air conditioning equipment appeared to have been maintained. Because of a lack of preventative maintenance throughout the USDB, a considerable amount of energy is being consumed with no appreciable contribution to the operation of the facility. The equipment controls are in need of maintenance the worst. A large portion of the control systems for the equipment were disconnected due to the lack of funding for repair. A preventative maintenance plan is currently under consideration at the USDB, but because of lack funding and proper personnel, the program could be in jeopardy.



Some of the feasible ECO's described in this report will replace equipment that might not have been replaced if the original equipment had had preventative maintenance.

Some of the equipment was not in service because of a pending repair, thus no energy was used. The calculations completed with an estimate of what the equipment might use if it were operating.

#### D. Computer Programs

A number of different computer programs were used in the development of this report. To calculate the energy usage of each of the buildings, we used a program entitled "Trace Ultra" provided by the Trane Company. This program uses an hour by hour energy calculation routine as presented in Chapter 25 of the American Society of Heating, Refrigeration, and Air conditioning Engineers (ASHRAE) Handbook of Fundamentals. Simplified energy calculations were completed using an electronic spreadsheet. The "Life Cycle Cost in Design" (LCCID) Economic Analysis Computer Program, developed by the Government thru the University of Illinois, was used to calculate the life cycle cost estimates.



#### PRESENT ENERGY CONSUMPTION

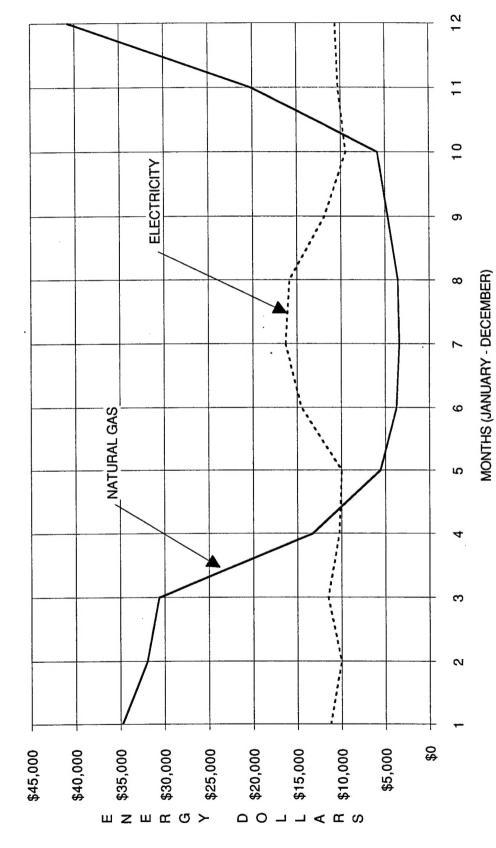
#### General Description

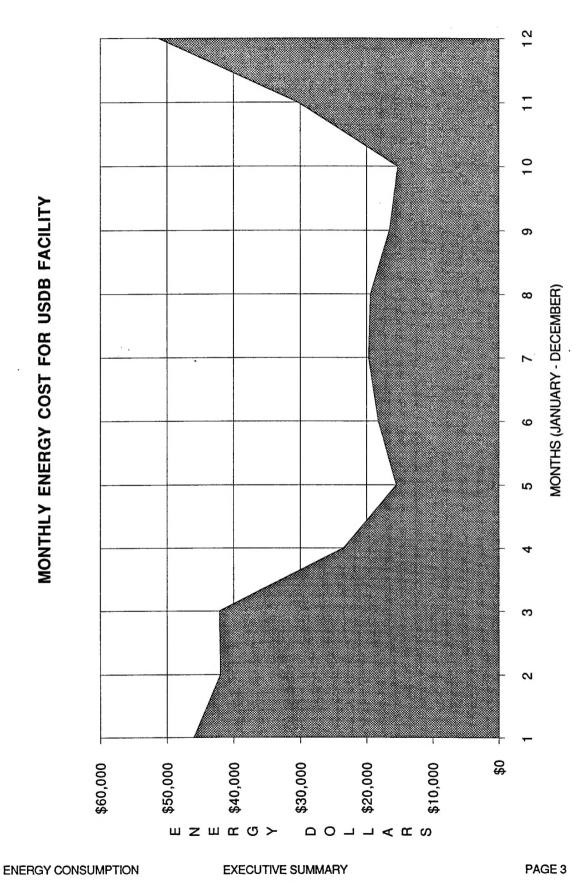
At the present time the energy usage associated with the United States Disciplinary Barracks (USDB) is in the form of three utilities. The first is electricity. The USDB uses electricity for all lighting, fan motors, and pump motors. The electricity used by the USDB is purchased from the electric utility for the area, Kansas Power and Light (KPL). The second utility used by the USDB is natural gas. Natural gas is used to fire the boilers in the boiler plant in the north section of the USDB. The boilers produce steam to be used in converters to make domestic hot water and in air handling unit coils for heating the spaces. The natural gas used to fire the boilers is purchased from the local gas utility Kansas Power and Light (KPL). Water is the third utility used in the USDB. The water is consumed in several different ways but in larger quantities by the inmate restrooms and showers. Water is purchased from a water plant owned and operated by Fort Leavenworth located on the grounds of the fort.

The following pages display the energy consumed per building studied and an overall energy consumption. Several buildings located in the USDB were not included in the scope of work to be studied. Therefore the overall energy usage would not be a total for the entire USDB. The energy usage included on the following pages is for the electrical and natural gas utilities. These energy usage amounts were calculated for each of the buildings. The USDB does not have metering available to check the amount of energy actually used.

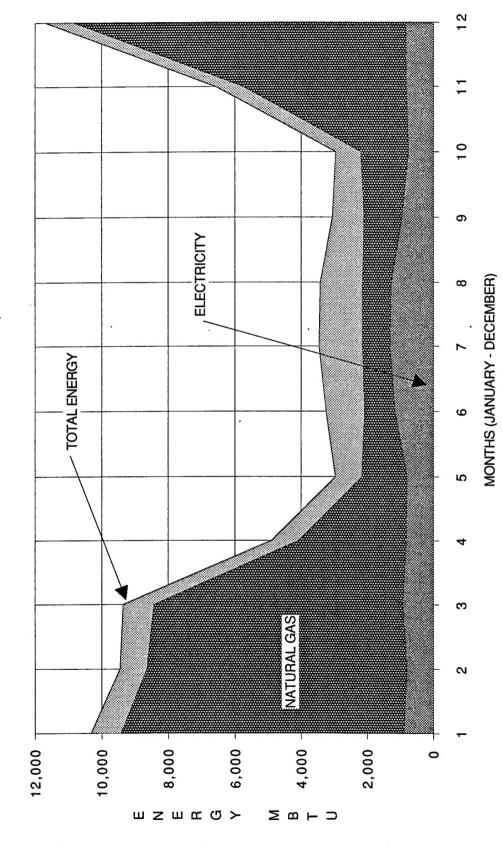


NATURAL GAS COST VS. ELECTRICITY COST





MONTHLY ENERGY USAGE FOR USDB FACILITY



#### SUMMARY OF ECO'S

#### ARCHITECTURAL

#### ECO A1. Reduce Infiltration

Presently, most of the windows and doors for the buildings located in the USDB have large cracks that allow outside air to infiltrate the buildings. Reduction of the air quantities entering the buildings is not difficult and can be accomplished by weatherstripping and caulking. This work can be performed by the maintenance staff at a low cost.

Because computer modeling of this ECO showed poor economic return, we do not recommend it.

#### ECO A2. Window Replacement

This ECO studied the installation of double glazed windows anywhere single glazed windows exist. The replacement windows are hermetically sealed with an air gap between the two plates of glass. Infiltration into the building is usually decreased because the new windows seal the opening better.

The double glazed windows have much better insulating quality than single glazed windows. However, they are expensive to install and will not provide an adequate payback unless new windows are already required. Therefore, we are not recommending this ECO.

#### ECO A3. Attic Insulation

The addition of insulation to the building attics will reduce the overall heat transfer coefficient of their roofs, translating into a decreased amount of heat transferred to or from the interior spaces of the building.

Installation of 10" fiberglass batt insulation in the attics of the existing buildings is not difficult and can be accomplished by the maintenance staff.

This ECO is recommended for buildings 464, 472, and 475.

#### ECO A4. Dock Door Replacement

This opportunity for heating energy conservation relates to a dock door located in building 470. The existing overhead dock door is in poor condition. The energy savings associated with a new door is derived from a reduction in heat transferred from interior spaces and from



decreased infiltration. The USDB carpentry shop would be required to replace the door to make the project feasible.

#### ECO A5. Vestibules

Vestibules reduce energy consumption by limiting the amount of outside air infiltration into buildings through frequently used doors. The implementation of this project will change the appearance of the exterior of building #463. At the present time, no vestibules exist at the entrance or exit of this building.

Especially during the heating season, the heating equipment runs nonstop to satisfy the space conditions. Most of the time, however, the temperature conditions are not met. If the heating and cooling equipment were adequately sized, a return on the investment due to energy savings would be more likely. However, we do not recommend this ECO based on existing conditions.

#### ECO A6. Solar Window Shading

This energy conservation opportunity was studied for all the buildings having cooling. The reduction in solar gain through an unshaded window is beneficial during the cooling season but not during the heating season.

An increase in heating energy may be required to offset the reduced solar heat gain in the winter. Some of the buildings that are entirely air conditioned and that contain large amounts of glass will save energy dollars by the addition of solar film, while other buildings experience increased energy consumption.

The only building showing a payback on this ECO is building 450.

#### ECO A7. Exterior Wall Insulation

The addition of insulation to exterior building walls was studied and found to be difficult to implement in a facility of this nature. The materials necessary must have reasonable resistance to damage due to the nature of the occupants of the buildings. Because of the expense this type of construction, implementation of this ECO is not feasible.

#### A9. Architectural Repairs

This section is not an ECO, but a study of architectural repairs recommended for USDB buildings. Many of the items considered do not have a direct relationship to an energy savings but are listed as recommended service items for the USDB. The repairs are small in nature, and some may reduce energy consumption in the buildings, but this is difficult to calculate.



#### MECHANICAL

#### ECO M1. Schedule Air Handling Equipment

This ECO studied energy savings associated with scheduling of HVAC equipment for shutoff or setback during periods when heating or cooling are required. This can be accomplished by adding some of the equipment to the existing Energy Management System (EMS) network. This project is recommended for building 465.

#### ECO M2. Dry-Bulb Economizer Controls

This ECO studies the service or addition of economizer controls and dampers to air handling units utilizing outside air at the present time. The economizer functions by using outside air for cooling when the outdoor temperature is low enough to provide cooling for the building (Approximately 60°F). The air handling units studied now have or had economizer controls and dampers, but do not function properly at this time. This ECO is not recommended at this time.

#### ECO M3. Service Steam Piping and Traps

This ECO studied the service or replacement of faulty steam traps. Energy savings are shown by a reduction in steam use if the failed traps are repaired so that they do not pass steam into the condensate piping. Steam traps are devices that consistently fail, and are designed to be easily replaceable and repairable. These devices need to be regularly checked and serviced or replaced, if necessary, for maximum system efficiency.

Failure to maintain the steam traps properly results in wasted energy and prevents air from being vented from the piping system, which corrodes the piping, causing premature pipe failure. This ECO is recommended for the USDB.

#### ECO M5.

This ECO studied the addition of heat recovery systems for the exhausted air from the cell barracks in the Castle Building. The locations of the heat recovery systems are ideal because the exhaust air is directly adjacent to the intake air to be preheated. This ECO is recommended for buildings 475C, 475D, 475G, and 475F.

#### ECO M6. Insulate Ductwork

This ECO investigates the addition of exterior insulation to supply air ductwork. The heat transferred through the walls of the ductwork is a function of the heat transfer coefficient of the ductwork material. Adding



insulation to the ductwork improves the heat transfer resistance and therefore limits the amount of energy lost.

Uninsulated ductwork routed through unconditioned areas wastes energy. The only ductwork at the USDB facility that is in this category is located in the exterior walls of the Castle building, where installation of insulation is not feasible.

#### ECO M10. Central Plant Cooling

This ECO studies the replacement of all the packaged air cooling equipment with a central plant chiller producing chilled water for cooling coils located in the air handlers at the individual buildings. In almost all of the cases where a space is being cooled, a packaged direct expansion type of cooling system is utilized.

The cost per BTUH of cooling by a direct expansion type of machine is greater than the cost per BTUH of chilled water system cooling. Replacing the existing direct expansion cooling equipment with a centrifugal chiller plant with cooling towers for heat rejection can conserve energy. However, the cost of removing the existing cooling equipment and installing new chilled water equipment and installing the chilled water distribution piping in the existing tunnels makes this project not feasible.

#### ECO M11. Castle Air System Repair

This ECO studied the energy savings associated with properly heating and ventilating the cell barracks of the Castle Building. At the present time, the air within the cell barracks is stratified. Air stratification occurs when warm air rises to the upper level of a building and cooler air settles to the lower level. This causes overheating of the upper level in order to provide adequate heating in the lower level.

Repairing the air system in the Castle Building allows the warmer air at the upper level to be recirculated down to the lower level, thereby reducing energy consumption in the building. This ECO is recommended in buildings 475C, 475D, 475F, and 475G.

#### ECO M12. Reduce Steam Distribution Pressure

This energy conservation opportunity deals with reducing the steam pressure needed for the USDB facility. The laundry requires 120 psi steam, while steam used for space heating can be supplied at 80 psi pressure. Lower pressure steam costs less to generate.

We recommend that the laundry facility be served by a single 120 psi boiler when the existing boilers are replaced (within the next two years).



The space heating requirements of the facility can then be served by two boilers operating at 80 psi.

#### ECO M14. Service Condensate Return System

This ECO analyzes the energy savings associated with the repair and insulation of the condensate return system serving the Castle Building. The existing piping has holes drilled in the top of the piping in various locations. Repairing these holes will result in less energy loss from the condensate. This repairing and insulating of the condensate piping will result in higher temperature condensate returning to the boiler plant, thus requiring less boiler energy to produce steam. This ECO is recommended.

#### ECO M15. Boiler Plant Modifications

This ECO studies the boiler plant and any modifications that could save energy. The energy lost during a blowdown of a boiler can be recovered and used to preheat the boiler feedwater. Installing a boiler stack economizer is another possible method of heat recovery off of the boilers. Preheating the combustion air to the boilers will save boiler energy. Oxygen trim control will help improve the operating efficiency of the boilers.

Seven items of energy conservation for the Boiler Plant were investigated and five items were eliminated. The two remaining items, boiler stack economizer and boiler oxygen trim control, offer energy savings.

We recommend that oxygen trim controls be purchased when the existing boilers are replaced within the next two years. Incorporation of any improvements to the existing boilers would be injudicious, because the payback could not be realized before the existing boilers are replaced.

#### ECO M24. Convert from Steam to Hot Water

This ECO studied the conversion of the existing high pressure steam generation and distribution system to a high temperature hot water type system. The cost per BTUH for using steam is greater than the cost per BTUH for using hot water. The required increase in system efficiency to justify the construction cost is not obtainable, making this ECO not feasible.

#### ECO M25. Convert from Steam to Cogeneration

Due to the large capital investment and the impact of the operating costs, a very detailed analysis must be performed before funding is considered

for cogeneration. The scope of this ECO is to determine if the investment in a complete cogeneration feasibility study is justified.

Cogeneration is possible when a large heating energy and cooling energy requirement occur simultaneously and for a sufficient time period. The feasibility of cogeneration depends on the facility electrical and thermal loads and how they interrelate. This is especially true when the cost of both electricity and natural gas are moderate, as they are at the USDB.

The most efficient system, offering the best return on investment, would be a cogeneration system tied into a central cooling plant utilizing absorption chillers, which could use the waste heat for cooling purposes.

#### ECO M26. Reduce Hot Water Temperature

This ECO studied the energy savings associated with a reduction of the domestic hot water temperature used for restrooms and showers. An energy savings can be realized by lower heat losses from the system.

This ECO can be implemented at no cost by directing the maintenance staff to change the setpoint for all water heaters within the USDB from 180°F to 140°F. The reduction in water temperature will reduce the capacity of the domestic hot water system. This ECO is recommended, however, its impact will be reduced by implementation of ECO-M30.

#### ECO M29. Decentralize Hot Water System

This ECO studied the break-up of the domestic hot water system. At the present time several buildings are served from a hot water tank located in one building. By decentralizing the hot water system, the heat loss from a considerable amount of branch piping can be eliminated. Due to the cost of construction required to implement this ECO, the project is not feasible.

#### ECO M30. Domestic Water Pipe Insulation

This energy conservation opportunity evaluates the installation of pipe insulation for the domestic hot water piping. Energy is saved by reducing the amount of heat loss from the piping to the surrounding environment. This ECO offers attractive energy savings in the Castle building and in the pipe tunnels and is recommended for the USDB.

#### ECO M31. Heat Recovery for Laundry

This ECO studied the addition of heat recovery units for the laundry washwater, clothes dryers, and the steam irons to conserve energy usage. The best opportunity for implementation of this ECO would be when the laundry facility reaches a permanent location. By this means.

PAGE 6

the heat recovery systems can be incorporated into the design more readily than for installation in an existing facility. Washwater and dryer heat recovery are recommended.

#### ECO M39. Water Heating Heat Pumps

This ECO studied the replacement of the existing heating and cooling equipment with a heat pump system to condition the interior spaces. In general, heat pumps have a greater efficiency than the existing types of heating and cooling equipment employed in the USDB buildings.

None of the buildings studied for heat pump installations were feasible due to the high construction costs. The heat pump system also has a higher maintenance cost than the existing heating and cooling equipment.



#### **ELECTRICAL**

#### ECO E1. Lighting Levels

This ECO investigates the reduction in lighting levels in areas where the existing lighting was considered to be more than necessary. Installation of motion sensors can provide a good payback in conference rooms and chapels where the lighting loads are high and the space is unoccupied 30% of the time.

#### ECO E2. Energy Efficient Lighting Systems

This ECO studies the replacement of existing lighting systems with more efficient lighting systems of the same light level. The replacement of lights would reduce the electrical consumption of the lighting system.

We recommend replacing the existing fluorescent lamps and ballasts with high efficiency lamps and ballasts during routine lighting maintenance by the USDB staff.

We also recommend replacement of the existing incandescent light fixtures in building #475A stairwells with high efficiency fluorescent fixtures.

#### ECO E3. Energy Efficient Motors

This ECO studied the replacement of existing motors that operate fans and pumps with high efficiency motors that have a higher KWh per horsepower rating. The increase in motor efficiency will decrease the amount of electrical energy used by the motors.

We recommend that the motors listed in Volume One of this report with calculated SIR values greater than 1.0 be replaced with high efficiency motors. We also recommend that all new motors installed at the USDB be high efficiency motors.



BUILDING #464	ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
BUILDING #463	REDUCE	INFILTRATION						
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BUILDING #475A   93   \$399   \$9,504   \$10,074   23.61   0								
A1   INVESTIGATION   93   \$399   \$9,504   \$10,074   23.61   0	A1	ROTUNDA	15	\$59	\$7,865	\$8,337	129.39	0.1
BUILDING #475B   DINING / LIBRARY   16		BUILDING #475A						
BUILDING #475B	A1	INVESTIGATION	93	\$399	\$9.504	\$10.074	23.61	0.6
A1 DINING / LIBRARY		BUILDING #475B						
BUILDING #475C	A1		16	\$65	\$9.793	\$10.381	151 20	0.1
A1 HSG_UNIT / RECEPTION 42 \$171 \$31,812 \$33,721 186,69 0 BUILDING #475D A1 HSG_UNIT / 4-BASE			- ' '		40,,00	<b>4</b> 10,001	101120	0.1
BUILDING #475D	Δ1		42	\$171	\$31.912	\$22 721	196 60	0.0
A1 HSG_UNIT /4-BASE			76	Ψ171	\$31,612	φυυ, <i>τ</i> ε ι	100.09	0.0
BUILDING #475E   A1	۸1		40	¢105	\$27.740	#40 042	100.07	0.0
A1 DINING / LAUNDRY / GYM 53 \$146 \$42,102 \$44,628 283.56 0 BUILDING #475F 89 \$365 \$37,990 \$40,269 105,02 0 BUILDING #475G 41 \$169 \$32,708 \$34,670 196,54 0 BUILDING #475H 41 \$169 \$32,708 \$34,07 92,50 0  WINDOW REPLACEMENT BUILDING #450 104 \$455 \$34,048 \$36,091 74,60 0 BUILDING #465 104 \$455 \$34,048 \$36,091 74,60 0 BUILDING #465 104 \$455 \$34,048 \$36,091 74,60 0 BUILDING #475H 42 \$317 \$104,902 \$111,196 331,03 0 BUILDING #475H 42 \$317 \$104,902 \$111,196 331,03 0 BUILDING #475H 42 \$578 \$208,538 \$221,050 318,52 0 BUILDING #475H 42 \$578 \$244,911 \$259,606 254,16 0 BUILDING #475H 42 \$578 \$244,911 \$259,606 323,81 0 BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$671 \$208,538 \$221,050 312,81 0  ATTIC INSULATION BUILDING #475H 43 \$244,911 \$259,606 323,81 0  ATTIC INSULATION \$259,606 323,81 1  BUILDING #475H 43 \$244,911 \$259,606 323,81 0  ATTIC INSULATION \$259,606 323,81 1  BUILDING #475H 43 \$244,911 \$259,606 323,81 0  BUILDING #475H 43 \$244,911 \$244,911 \$259,606 323,81 0  BUILDING #475H	<u> </u>			\$195	\$37,748	\$40,013	193.27	. 0.0
BUILDING #475F A1 HSG. UNIT BUILDING #475G A1 HSG. UNIT A1 \$169 \$32,708 \$34,670 196.54 0. BUILDING #475H A1 MSA / D&A BOARD / TDS 20 \$85 \$7,563 \$8,017 92.50 0.  WINDOW REPLACEMENT BUILDING #455 A2 MENTAL HYGIENE 104 \$455 \$34,048 \$36,091 74.60 0. BUILDING #465 A2 INSIDE BARBER SHOP 217 \$892 \$369,241 \$391,395 414.93 0. BUILDING #475C A2 ROTUNDA 78 \$317 \$104,902 \$111,196 331,03 0. BUILDING #475C A2 HSG. UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0. BUILDING #475F A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0. BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION BUILDING #475  3208,538 \$221,050 312.81 0. BUILDING #475G 321 \$360,000 \$300,000	4.4			44.40				
A1 HSG, UNIT	A1		53	\$146	\$42,102	\$44,628	283.56	. 0.0
BUILDING #475G A1 HSG, UNIT A1 S169 \$32,708 \$34,670 196.54 0 BUILDING #475H A1 MSA / D&A BOARD / TDS 20 \$85 \$7,563 \$8,017 92.50 0  WINDOW REPLACEMENT  BUILDING #450 A2 MENTAL HYGIENE 104 \$455 \$34,048 \$36,091 74,60 0. BUILDING #450 A2 INSIDE BARBER SHOP 217 \$892 \$369,241 \$391,395 414.93 0. BUILDING #475 A2 ROTUNDA 78 \$317 \$104,902 \$111,196 331.03 0. BUILDING #475C A2 HSG, UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0. BUILDING #475D A2 HSG, UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0. BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #475C A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  BUILDING #475G A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475								
A1 HSG_UNIT	A1		89	\$365	\$37,990	\$40,269	105.02	0.1
BUILDING #475H A1 MSA / D&A BOARD / TDS 20 \$85 \$7,563 \$8,017 92.50 0  WINDOW REPLACEMENT  BUILDING #450 A2 MENTAL HYGIENE 104 \$455 \$34,048 \$36,091 74.60 0.  BUILDING #455 A2 INSIDE BARBER SHOP 217 \$892 \$369,241 \$391,395 414.93 0.  BUILDING #475 A2 ROTUNDA 78 \$317 \$104,902 \$1111,196 331.03 0.  BUILDING #475C A2 HSG. UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0.  BUILDING #475D A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0.  BUILDING #475G A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #475 BUILDING #475 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 BUILDING #475E BUILDING #475E		IBUILDING #475G						
MSA / D&A BOARD / TDS   20								
WINDOW REPLACEMENT    BUILDING #450   A2   MENTAL HYGIENE   104   \$455   \$34,048   \$36,091   74.60   0.0	A1_	HSG. UNIT	41	\$169	\$32,708	\$34,670	196.54	0.0
BUILDING #450   MENTAL HYGIENE   104    \$455    \$34,048    \$36,091    74.60    0.0		HSG. UNIT BUILDING #475H				\$34,670	196.54	
A2 MENTAL HYGIENE 104 \$455 \$34,048 \$36,091 74.60 0.  BUILDING #465 A2 INSIDE BARBER SHOP 217 \$892 \$369,241 \$391,395 414.93 0.  BUILDING #475 A2 ROTUNDA 78 \$317 \$104,902 \$111,196 331.03 0.  BUILDING #475C A2 HSG. UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0.  BUILDING #475D A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0.  BUILDING #475F A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475E BUILDING #475E BUILDING #475E BUILDING #475E		HSG. UNIT BUILDING #475H						
BUILDING #465	A1	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS						0.0
BUILDING #465 A2 INSIDE BARBER SHOP 217 \$892 \$369,241 \$391,395 414,93 0. BUILDING #475 A2 ROTUNDA 78 \$317 \$104,902 \$111,196 331.03 0. BUILDING #475C A2 HSG. UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0. BUILDING #475D A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0. BUILDING #475F A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0. BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2. BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1. BUILDING #475 BUILDING #475E	A1	HSG. UNIT BUILDING #475H MSA / D&A BOARD / TDS						
BUILDING #475 A2 ROTUNDA BUILDING #475C A2 HSG. UNIT / RECEPTION BUILDING #475D A2 HSG. UNIT / 4-BASE BUILDING #475F A2 HSG. UNIT / 4-BASE BUILDING #475G A2 HSG. UNIT / 5-BASE BUILDING #475G A3 PRINT SHOP / COLLEGE BUILDING #464 A3 OUTSIDE BARBER SHOP BUILDING #475 BUILDING #475E BUILDING #475E	A1 WINDOW	HSG. UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450	20	\$85	\$7,563	\$8,017	92.50	0.1
BUILDING #475 A2 ROTUNDA 78 \$317 \$104,902 \$111,196 331.03 0.  BUILDING #475C A2 HSG. UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0.  BUILDING #475D A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0.  BUILDING #475F A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 BUILDING #475E	A1 WINDOW	HSG. UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE	20	\$85	\$7,563	\$8,017	92.50	
A2 ROTUNDA 78 \$317 \$104,902 \$111,196 331.03 0.  BUILDING #475C A2 HSG. UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0.  BUILDING #475D A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0.  BUILDING #475F A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.	A1 WINDOW A2	HSG. UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465	20	\$85 \$455	\$7,563 \$34,048	\$8,017 \$36,091	92.50 74.60	0.1
BUILDING #475C A2 HSG. UNIT / RECEPTION BUILDING #475D A2 HSG. UNIT / 4-BASE BUILDING #475F A2 HSG. UNIT BUILDING #475G A2 HSG. UNIT BUILDING #475G A2 HSG. UNIT / FEM HSG BUILDING #475G A2 HSG. UNIT / FEM HSG BUILDING #475C A2 HSG. UNIT / FEM HSG BUILDING #475C A3 PRINT SHOP / COLLEGE BUILDING #475 BUILDING #475E BUILDING #475E	A1 WINDOW A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP	20	\$85 \$455	\$7,563 \$34,048	\$8,017 \$36,091	92.50 74.60	0.1
A2 HSG. UNIT / RECEPTION 161 \$658 \$208,538 \$221,050 318.52 0.  BUILDING #475D A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0.  BUILDING #475F A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 BUILDING #475E	A1 WINDOW A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475	104 217	\$85 \$455 \$892	\$7,563 \$34,048 \$369,241	\$8,017 \$36,091 \$391,395	92.50 74.60 414.93	0.1
BUILDING #475D  A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0.  BUILDING #475F  A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G  A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464  A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472  A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475  A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.	A1 WINDOW A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA	104 217	\$85 \$455 \$892	\$7,563 \$34,048 \$369,241	\$8,017 \$36,091 \$391,395	92.50 74.60 414.93	0.1
A2 HSG. UNIT / 4-BASE 237 \$967 \$244,911 \$259,606 254.16 0.  BUILDING #475F A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.	A1 WINDOW A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C	104 217 78	\$85 \$455 \$892 \$317	\$7,563 \$34,048 \$369,241 \$104,902	\$8,017 \$36,091 \$391,395 \$111,196	92.50 74.60 414.93 331.03	0.1 0.2 0.0 0.0
BUILDING #475F A2 HSG, UNIT 186 \$761 \$244,911 \$259,606 323.81 0. BUILDING #475G A2 HSG, UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2. BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1. BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2. BUILDING #475E	A1 WINDOW A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG. UNIT / RECEPTION	104 217 78	\$85 \$455 \$892 \$317	\$7,563 \$34,048 \$369,241 \$104,902	\$8,017 \$36,091 \$391,395 \$111,196	92.50 74.60 414.93 331.03	0.1 0.2 0.0 0.0
A2 HSG. UNIT 186 \$761 \$244,911 \$259,606 323.81 0.  BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.	A1 WINDOW A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG. UNIT / RECEPTION BUILDING #475D	104 217 78 161	\$85 \$455 \$892 \$317 \$658	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050	92.50 74.60 414.93 331.03 318.52	0.1 0.2 0.0 0.0
BUILDING #475G A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.	A1 WINDOW A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE	104 217 78 161	\$85 \$455 \$892 \$317 \$658	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050	92.50 74.60 414.93 331.03 318.52	0.1 0.2 0.0 0.0
A2 HSG. UNIT / FEM HSG 164 \$671 \$208,538 \$221,050 312.81 0.  ATTIC INSULATION  BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.  BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F	104 217 78 161 237	\$455 \$455 \$892 \$317 \$658 \$967	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606	92.50 74.60 414.93 331.03 318.52 254.16	0.1 0.2 0.0 0.0 0.0
ATTIC INSULATION  BUILDING #464  A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472  A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475  A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.  BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT	104 217 78 161 237	\$455 \$455 \$892 \$317 \$658 \$967	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606	92.50 74.60 414.93 331.03 318.52 254.16	0.1 0.2 0.0 0.0 0.0
BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.  BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT BUILDING #475G	104 217 78 161 237 186	\$455 \$455 \$892 \$317 \$658 \$967 \$761	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606	92.50 74.60 414.93 331.03 318.52 254.16 323.81	0.1 0.2 0.0 0.0 0.0 0.0
BUILDING #464 A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.  BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT BUILDING #475G	104 217 78 161 237 186	\$455 \$455 \$892 \$317 \$658 \$967 \$761	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606	92.50 74.60 414.93 331.03 318.52 254.16 323.81	0.1 0.2 0.0 0.0 0.0 0.0
A3 OUTSIDE BARBER SHOP 106 \$583 \$3,215 \$3,408 5.54 2.  BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.  BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / BUILDING #475G HSG, UNIT / HSG HSG, UNIT / FEM HSG	104 217 78 161 237 186	\$455 \$455 \$892 \$317 \$658 \$967 \$761	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606	92.50 74.60 414.93 331.03 318.52 254.16 323.81	0.1 0.2 0.0 0.0 0.0 0.0
BUILDING #472 A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1. BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2. BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A2	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / 4-BASE BUILDING #475G HSG, UNIT / FEM HSG SULATION	104 217 78 161 237 186	\$455 \$455 \$892 \$317 \$658 \$967 \$761	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606	92.50 74.60 414.93 331.03 318.52 254.16 323.81	0.1 0.2 0.0 0.0 0.0 0.0
A3 PRINT SHOP / COLLEGE 34 \$194 \$2,438 \$2,584 11.72 1.  BUILDING #475  A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2.  BUILDING #475E	A1 WINDOW A2 A1	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG. UNIT / RECEPTION BUILDING #475D HSG. UNIT / 4-BASE BUILDING #475F HSG. UNIT / FEM HSG  SULATION BUILDING #464	104 217 78 161 237 186 164	\$455 \$892 \$317 \$658 \$967 \$761 \$671	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81	0.1 0.2 0.0 0.0 0.0
BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2. BUILDING #475E	A1 WINDOW A2 A1	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG. UNIT / RECEPTION BUILDING #475D HSG. UNIT / 4-BASE BUILDING #475F HSG. UNIT / 4-BASE BUILDING #475G HSG. UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP	104 217 78 161 237 186 164	\$455 \$892 \$317 \$658 \$967 \$761 \$671	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81	0.1 0.2 0.0 0.0 0.0 0.0
BUILDING #475 A3 ROTUNDA 142 \$578 \$4,592 \$4,868 7.96 2. BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A3	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472	104 217 78 161 237 186 164	\$455 \$892 \$317 \$658 \$967 \$761 \$671	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81	0.1 0.2 0.0 0.0 0.0 0.0
BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A3	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE	104 217 78 161 237 186 164	\$455 \$892 \$317 \$658 \$967 \$761 \$671	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81	0.1 0.2 0.0 0.0 0.0 0.0 0.0
BUILDING #475E	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A3 ATTIC IN:	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #475G HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE BUILDING #475	104 217 78 161 237 186 164	\$455 \$892 \$317 \$658 \$967 \$761 \$671	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81	0.1 0.2 0.0 0.0 0.0 0.0 0.0
	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A3 ATTIC IN:	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475F HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE BUILDING #475 ROTUNDA	104 217 78 161 237 186 164	\$455 \$892 \$317 \$658 \$967 \$761 \$671	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050 \$3,408 \$2,584	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81 5.54 11.72	0.1 0.2 0.0 0.0 0.0 0.0 0.0 2.5 1.1
A3 DINING / LAUNDRY / GYM 40 \$169 \$30,487 \$32,316 187.69 0.	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A3 A3 A3	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE BUILDING #475 ROTUNDA BUILDING #475 ROTUNDA BUILDING #475	104 217 78 161 237 186 164 106 34	\$455 \$892 \$317 \$658 \$967 \$761 \$671 \$583 \$194 \$578	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050 \$3,408 \$2,584	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81 5.54 11.72	0.1 0.2 0.0 0.0 0.0 0.0 0.0 2.5 1.1
	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A3 ATTIC IN:	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475F HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE BUILDING #475 ROTUNDA	104 217 78 161 237 186 164 106 34	\$455 \$892 \$317 \$658 \$967 \$761 \$671 \$583 \$194 \$578	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438 \$4,592	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050 \$3,408 \$2,584 \$4,868	92.50  74.60  414.93  331.03  318.52  254.16  323.81  312.81  5.54  11.72  7.96	0.1  0.2  0.0  0.0  0.0  0.0  0.0  2.5  1.1
DOCK DOOR REPLACEMENT	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A3 A3 A3 A3	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT  BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE BUILDING #475 BUILDING #475E DINING / LAUNDRY / GYM	104 217 78 161 237 186 164 106 34	\$455 \$892 \$317 \$658 \$967 \$761 \$671 \$583 \$194 \$578	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438 \$4,592	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050 \$3,408 \$2,584	92.50 74.60 414.93 331.03 318.52 254.16 323.81 312.81 5.54 11.72	0.1
BUILDING #470	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A3 A3 A3 A3	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT  BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE BUILDING #475 BUILDING #475E DINING / LAUNDRY / GYM	104 217 78 161 237 186 164 106 34	\$455 \$892 \$317 \$658 \$967 \$761 \$671 \$583 \$194 \$578	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438 \$4,592	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050 \$3,408 \$2,584 \$4,868	92.50  74.60  414.93  331.03  318.52  254.16  323.81  312.81  5.54  11.72  7.96	0.1  0.2  0.0  0.0  0.0  0.0  0.0  2.5  1.1
	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A3 A3 A3 A3	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  / REPLACEMENT  BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475F HSG, UNIT / FEM HSG  SULATION BUILDING #464 OUTSIDE BARBER SHOP BUILDING #472 PRINT SHOP / COLLEGE BUILDING #475 BUILDING #475E DINING / LAUNDRY / GYM	104 217 78 161 237 186 164 106 34 142 40	\$455 \$892 \$317 \$658 \$967 \$761 \$671 \$583 \$194 \$578	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438 \$4,592	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050 \$3,408 \$2,584 \$4,868	92.50  74.60  414.93  331.03  318.52  254.16  323.81  312.81  5.54  11.72  7.96	0.1 0.2 0.0 0.0 0.0 0.0 0.0 2.5 1.1
A4 POPE HALL / VOC SHOP 17 \$69 \$870 \$922 12.65 1	A1 WINDOW A2 A2 A2 A2 A2 A2 A2 A2 A3 A3 A3 A3 A3	HSG, UNIT BUILDING #475H MSA / D&A BOARD / TDS  REPLACEMENT BUILDING #450 MENTAL HYGIENE BUILDING #465 INSIDE BARBER SHOP BUILDING #475 ROTUNDA BUILDING #475C HSG, UNIT / RECEPTION BUILDING #475D HSG, UNIT / 4-BASE BUILDING #475G HSG, UNIT / FEM HSG  SULATION BUILDING #475G HSG, UNIT / FEM HSG  SULATION BUILDING #475 BUILDING #475E DINING / LAUNDRY / GYM  OOR REPLACEMENT BUILDING #470	104 217 78 161 237 186 164 106 34 142 40	\$455 \$892 \$317 \$658 \$967 \$761 \$671 \$583 \$194 \$578 \$169	\$7,563 \$34,048 \$369,241 \$104,902 \$208,538 \$244,911 \$244,911 \$208,538 \$3,215 \$2,438 \$4,592 \$30,487	\$8,017 \$36,091 \$391,395 \$111,196 \$221,050 \$259,606 \$259,606 \$221,050 \$3,408 \$2,584 \$4,868 \$32,316	92.50  74.60  414.93  331.03  318.52  254.16  323.81  312.81  5.54  11.72  7.96  187.69	0 0 0 0 0 0 0 0 0

<sup>\*</sup> TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
		MOTO OF TITE	1Ψ7	330,	0001	TEMIO 1	
VESTIB							
A5	BUILDING #463 SOUTH GATE / VISITORS	12	\$49	\$88,238	\$93,532	1807.08	0.01
SOLAR	WINDOW SHADING						
JOLAN	BUILDING #450	T		T T			
A6	MENTAL HYGIENE	80	\$498	\$2,001	\$2,121	7.84	1.66
70	BUILDING #463	50	ψ430	Ψ2,001	ΨΕ, ΙΕ Ι	7.04	1.00
A6	SOUTH GATE / VISITORS	-17	(\$53)	\$2,056	\$2,179	-73.68	-0.37
70	BUILDING #464	-1/	(ψου)	ψ2,000	Ψ2,173	-70.00	-0.07
A6	OUTSIDE BARBER SHOP	-11	(\$26)	\$1,782	\$1,889	-596.00	-0.20
	BUILDING #472	-11	(\$20)	Ψ1,702	\$1,009	-390.00	-0,20
A6	PRINT SHOP / COLLEGE	18	\$74	\$835	\$885	37.41	0.30
AO	BUILDING #473	10	9/4	φουυ	φοου	37.41	0.30
A6	CLASSIFICATION	-11	\$11	\$2,565	\$2,719	85.80	-0.03
AG	BUILDING #475A	-11	\$11	φ2,303	φ2,/19	85,60	-0,03
100		20	6406	#0.000	60 504	20.00	0.55
A6	INVESTIGATION BUILDING #475B	32	\$406	\$8,020	\$8,501	20.22	0.55
1 46		_	074	60 774	60.040	27.40	0.00
A6	DINING / LIBRARY	6	\$74	\$2,774	\$2,940	37.12	0.30
46	BUILDING #475H	_	eco	#0.010	<b>00.707</b>	40.00	0.00
A6	MSA / D&A BOARD / TDS	5	\$60	\$2,610	\$2,767	42.26	0.26
EVTEN	OD WALL BUOLD ATION						
EXIEHI	OR WALL INSULATION						
4.7	BUILDING #472	200	A4 507	457.040	***	54.00	
A7	PRINT SHOP / COLLEGE	229	\$1,507	\$57,916	\$61,391	54.83	. 0.28
	BUILDING #475C						
A7	HSG. UNIT / RECEPTION	154	\$628	\$158,675	\$168,196	253.55	0.06
ARCHII	TECTURAL REPAIRS	······································		,			
7	BUILDING #463						
″ <u>A9</u>	SOUTH GATE / VISITORS			\$424	\$449		
1	BUILDING #465						
A9	INSIDE BARBER SHOP			\$1,671	\$1,771		
	BUILDING #466					ł	
A9	CARPENTRY SHOP			\$582	\$617		
1	BUILDING #472	1					
A9	PRINT SHOP / COLLEGE			\$1,219	\$1,292		
	BUILDING #473	1					
A9	CLASSIFICATION			\$2,132	\$2,260		
	BUILDING #475						
A9	ROTUNDA			\$13,727	\$14,551		
	BUILDING #475A						
A9	INVESTIGATION			\$1,221	\$1,294		
	BUILDING #475E	1					
A9	DINING / LAUNDRY / GYM			\$50,302	\$53,320		
SCHED	<u>ULE AIR HANDLING EQUIPM</u>	ENT					
	BUILDING #463						
M1	SOUTH GATE / VISITORS	10	\$51	\$464	\$492	9.32	0.93
	BUILDING #464						
M1	OUTSIDE BARBER SHOP	45	\$396	\$8,731	\$9,255	21.85	0.42
	BUILDING #465						
M1	INSIDE BARBER SHOP	280	\$891	\$9,408	\$9,972	10.57	1.03
DRY-BU	JLB ECONOMIZER CONTROL	.S					
	BUILDING #463						
M2	SOUTH GATE / VISITORS	0	\$3	\$1,459	\$1,547	488.00	0.02
1	BUILDING #464						
		401	<b>#150</b>	\$1,333	Ø1 412	0.05	
M2	OUTSIDE BARBER SHOP	13	\$156	্ ক।,১১১	\$1,413	8.85	0.97
M2 M2	BUILDING #473 CLASSIFICATION	13	\$156	\$1,333 \$1,333	\$1,413	191.00	0.97

<sup>\*</sup> TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH

	ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
	SERVICE	STEAM PIPING AND TRAF	es					
	МЗ	OWNER TESTING	1,510	\$6,161	\$15,738	\$16,682	2.56	4.55
İ	_M3	OUTSIDE TESTING	1,510	\$6,161	\$16,150	\$17,119	2.63	4.44
								_
	EXHAUS'	HEAT RECOVERY						
	M5	Q-DOT SYSTEM	453	\$2,130	\$12,178	\$12,909	6.66	1.76
Ì	M5	Z-DUCT SYSTEM	294	\$1,568	\$12,795	\$13,563	10.81	1.08
	M5	COIL LOOP	301	\$953	\$15,352	\$16,273	12.81	0.92
	INSULAT	E DUCTWORK						
1	M6	THIS ECO IS NOT NOT COST EFFECTIVE						
		PLANT COOLING	<u> </u>				L	····
-		ALL BUILDINGS IN THE	000	40 707	244.545	4474.045	400.00	
Į	M10	USDB FACILITY	220	\$2,737	\$444,542	\$471,215	162.99	0.05
	CASTLE	AIR SYSTEM REPAIR	,					
	M11	BUILDING #475C HSG. UNIT / RECEPTION	273	\$1,458	\$1,678	\$1,779	1.51	7.72
	M11	BUILDING #475D HSG. UNIT / 4-BASE	277	\$1,474	\$1,678	\$1,779	1.49	7.83
3	M11	BUILDING #475F HSG. UNIT	307	\$1,641	\$1,678	\$1,779	1.34	8.68
1	M11	BUILDING #475G HSG. UNIT	247	\$1,323	\$1,678	\$1,779	1.67	6.99
	REDUCE	STEAM DISTRIBUTION PR	ESSURE					
		ALL BUILDINGS IN THE						
ı	M12	USDB FACILITY	605	\$2,470	\$9,369	\$9,931	3.81	3.06
	CONDEN	SATE RETURN SYSTEM SE	RVICE					
	M14	ALL BUILDINGS IN THE USDB FACILITY	1,687	\$6,883	\$35,958	\$38,115	5.24	2.23
	BOILER F	PLANT MODIFICATIONS						
		ECONOMIZER HEAT RECOVERY	280	\$1,142	\$22.052	¢04.000	00.00	0.50
1	M15	OXYGEN TRIM			\$22,852	\$24,223	20.08	0.58
L		CONTROLS	3,397	\$13,860	\$36,865	\$39,077	2.67	4.37
Г	CONVER	FROM STEAM TO HOT W ALL BUILDINGS IN THE	ATER					
	M24	USDB FACILITY	14,464	\$52,024	\$634,367	\$672,429	12.24	1.00
	CONVERT	FROM STEAM TO COGEN	IERATION					
	M25	ALL BUILDINGS IN THE USDB FACILITY		\$58,138	\$1,200,000	\$1,272,000	21.00	
L		2220173012711		ψυ0,100	φ1,200,000	φ1,212,000	21.00	



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$\overline{\ }$		BUILDING	ENERGY	ENERGY		TOTAL	SIMPLE	
	ECO	NAME	SAVINGS	SAVINGS	CONSTRUCTION	PROJECT	PAYBACK	SIR
		<u> </u>	MBTU'S/YR	(\$)	COST	COST*	YEARS	
D	EDUCE	HOT WATER TEMPERATU	DE					
L.	LUCCE	IBUILDING #475	15					
	M26	ROTUNDA	23	\$92	\$0	\$0	IMMEDIATELY	
		CASTLE BUILDINGS			T.			****
L	M26	475C, 475D, 475F, 475G	51	\$210	\$0	\$0	IMMEDIATELY	
Г		BUILDING #475E						
$\perp$	M26	DINING / LAUNDRY / GYM	33	\$134	\$0	\$0	IMMEDIATELY	
	1.100			****				
<u> </u>	M26	TUNNELS	73	\$299	\$0	\$0	IMMEDIATELY	
ות	ECENIT	RALIZE HOT WATER SYSTE	ENA.					
<u> </u>	ECENT	BLDGS, 450, 463, 464,	I I				T T	
	M29	466, 467, 468, 472, & 473	243	\$1,296	\$19,599	\$20,775	19.85	0.59
-	10120	1400, 407, 400, 472, 4 470 1	240	Ψ1,230	ψ13,533	Ψ20,773	19.001	0.55
D	OMEST	IC WATER PIPE INSULATIO	N					
Г		1					I	
$\perp$	M30	CASTLE BUILDING	147	\$787	\$1,365	\$1,447	2.28	5.11
L	M30	PIPE TUNNELS	55	\$293	\$454	\$481	2.03	5.75
	- A T D C	COVERY FOR LAURIDAY						
H	EALKE	COVERY FOR LAUNDRY						
	M31	WASH WATER HEAT RECOVERY	3,871	\$15.742	¢40,000	¢46.450	0.70	4.40
$\vdash$	IVIST	DRYER EXHAUST	3,071	\$15,742	\$43,829	\$46,459	2.79	4.18
	M31	HEAT RECOVERY	2,748	\$10.597	\$111,688	\$118,389	10.58	1.13
_					Ψ111,000	Ψ110,003		1.10
W	ATER H	IEATING HEAT PUMPS		·				
		BUILDING #450						
- L	M39	MENTALHYGIENE	9	\$117	\$73,293	\$77,691	656.70	0.01
		BUILDING #463						
_	M39	SOUTH GATE / VISITORS	1	\$106	\$53,565	\$56,779	521.87	0.02
	M39	BUILDING #464	46	#100	<b>#50.005</b>	400.000	24.40	
	MOS	OUTSIDE BARBER SHOP BUILDING #465	16	\$163	\$59,685	\$63,266	34.46	0.34
	M39	INSIDE BARBER SHOP	307	\$1,342	\$39,012	\$41,353	29,11	0.20
	11100	BUILDING #472	307	Ψ1,042	φ39,012	φ41,333	29,11	0.39
1	M39	PRINT SHOP / COLLEGE	166	\$851	\$159,692	\$169,274	189.65	0.06
		BUILDING #473			7,00,002	φ100,E11	100.00	0.00
L	M39	CLASSIFICATION	17	\$212	\$86,261	\$91,437	410.25	0.02
-		BUILDING #475A						
$\vdash$	M39	INVESTIGATION	20	\$249	\$97,188	\$103,019	391.68	0.02
	1400	BUILDING #475B						
$\vdash$	M39	DINING / LIBRARY	12	\$154	\$61,228	\$64,902	412.37	0.02
	M39	BUILDING #475H MSA / D&A BOARD / TDS	9	\$115	010.015	240 700		
-	IVIOS	IMSA / DAA BOARD / IDS	9	\$115	\$46,915	\$49,730	420.35	0.02
11	GHTING	LEVELS						
<u> </u>		BUILDING #450	T				I	
L	E1	CONFERENCE ROOM	3	\$34	\$201	\$213	5.90	1.90
		BUILDING #475A		·	423,1	42.0	5.50	1.30
L	E1	CONFERENCE ROOM	1	\$17	\$201	\$213	11.80	0.90
		BUILDING #475A						
$\vdash$	E1	CHAPEL	3	\$43	\$201	\$213	4.70	2.40
	E4	BUILDING #475E		4				
$\vdash$	E1	BUILDING #475B	1	\$13	\$201	\$213	15.70	0.70
	E1	CHAPEL	اہ	640	0004			
		BUILDING #475H	3	\$40	\$201	\$213	5.00	2.20
	E1	CHAPEL	2	\$21	\$201	\$213	9.50	1 00
	<del></del>			Ψ4.1	Φ∠01	<b>⊅</b> ∠13	9.50	1.20



ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
ENERGY	EFFICIENT LIGHTING SYS	TEMS					
E2	BUILDING #475A INVESTIGATION	8	\$100	\$124	\$131	1.24	9.00
ENERGY	EFFICIENT MOTORS						
E3	ALL BUILDINGS IN THE USDB FACILITY	248	\$3,085	\$20,929	\$22,185	6.80	1.60



#### ALL ECO'S RECOMMENDED

AL	L ECO	S RECOMMENDED						
1	ECO	BUILDING NAME	ENERGY SAVINGS	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
			MBTU'S/YR	(0)	0001			
ΑT	TTIC INS	SULATION						
		BUILDING #464	106	\$583	\$3,215	\$3,408	5.54	2.57
-	A3	OUTSIDE BARBER SHOP	100			<b>20 504</b>	11.72**	1.19
L	A3	PRINT SHOP / COLLEGE	34	\$194	\$2.438	\$2,584	11.72	
	A3	BUILDING #475 ROTUNDA	142	\$578	\$4,592	\$4,868	7.96	2.03
<u>_</u>								
D	OCK DO	OOR REPLACEMENT TBUILDING #470						1.28
	A4	POPE HALL / VOC SHOP	17	\$69	\$870	\$922	12.65**	1.20
_								
S	OLAR V	VINDOW SHADING BUILDING #450				CO 101	5.00	2.96
L	A6	MENTAL HYGIENE	80	\$498	\$2,001	\$2,121	3.001	
•	CHEDII	LE AIR HANDLING EQUIPM	IENT					
٦	CHEDO	BUILDING #465		2004	\$9,408	\$9.972	10.57**	1.03
L	M1	INSIDE BARBER SHOP	280	\$891	\$9,400	00.072		
s	ERVICE	STEAM PIPING AND TRAF	·s					
Ī			1,510	\$6,161	\$15,738	\$16,682	2.56	4.55
-	M3_	OWNER TESTING	1,510	\$0,101		247.440	2.63	4.44
· L	М3_	OUTSIDE TESTING	1,510	\$6,161	\$16,150	\$17,119	2.001	
		• .						*
E	XHAUS	T HEAT RECOVERY			T			
_,	145	Q-DOT SYSTEM	453	\$2,130	\$12,178	\$12,909	6.66	1.76
<u>ــ</u>	M5	Q-DOT STOTEM				\$13,563	10.81**	1.08
	M5	Z-DUCT SYSTEM	294	\$1,568	\$12,795	φ10,500		
٠ ,	ASTLE	AIR SYSTEM REPAIR						
۲		BUILDING #475C	070	\$1,458	\$1,678	\$1,779	1.51	7.72
-	M11	HSG. UNIT / RECEPTION BUILDING #475D	273	\$1,450			1.40	. 7.83
	M11	HSG. UNIT / 4-BASE	277	\$1,474	\$1,678	\$1,779	1.49	. 7.00
Γ	1444	BUILDING #475F	307	\$1.641	\$1,678	\$1,779	1.34	8.68
-	M11	HSG. UNIT BUILDING #475G	307		24.670	61 770	1.67	6.99
L	M11	HSG. UNIT	247	\$1,323	\$1,678	\$1,779	1.071	
	שבחווכי	E STEAM DISTRIBUTION PE	RESSURE					
ŕ	TEDOC	ALL BUILDINGS IN THE		20.476	\$9,369	\$9,931	3.81	3.06
L	M12	USDB FACILITY	605	\$2,470	φ9,503	40,00		
(	CONDE	NSATE RETURN SYSTEM S	ERVICE					
ſ		ALL BUILDINGS IN THE	1,687	\$6,883	\$35,958	\$38,115	5.24	2.23
L	M14	USDB FACILITY	1,88	30,00	000,000			
1	BOILER	PLANT MODIFICATIONS				T		
Γ	1445	OXYGEN TRIM	3,39	\$13,860	\$36,865	\$39,077	2.67	4.37
L	M15	CONTROLS	3,35	, <u> </u>				

<sup>\*</sup>TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH



#### ALL ECO'S RECOMMENDED

	TOTAL SIMPLE										
1	BUILDING	ENERGY	ENERGY		TOTAL		SIR				
ECO	NAME	SAVINGS	SAVINGS	CONSTRUCTION	PROJECT	PAYBACK	SIL				
		MBTU'S/YR	(\$)	COST	COST*	YEARS					
L	J										
REDUCE	HOT WATER TEMPERATUR	RE									
	BUILDING #475					IMMEDIATELY					
M26	ROTUNDA	23	\$92	\$0	\$0	IMMEDIATELT					
	CASTLE BUILDINGS					IMMEDIATELY					
M26	475C, 475D, 475F, 475G	51	\$210	\$0	\$0	ININEDIATELT					
	BUILDING #475E					IMMEDIATELY					
M26	DINING / LAUNDRY / GYM	33	\$134	\$0	50	INIVIEDIATELT					
				20	۴۵.	IMMEDIATELY					
M26	TUNNELS	73	\$299	\$0	20	HIVINEDIATELT					
DOMEST	IC WATER PIPE INSULATION	NN									
				04.005	\$1,447	2.28	5.11				
M30	CASTLE BUILDING	147	\$787	\$1,365	\$1,447	2.20					
				<b>*454</b>	\$481	2.03	5.75				
M30	PIPE TUNNELS	55	\$293	\$454	9401	2.00					
<b>HEAT RE</b>	COVERY FOR LAUNDRY										
	WASH WATER			040,000	\$46,459	2.79	4.18				
M31	HEAT RECOVERY	3,871	\$15,742	\$43,829	\$40,435						
	TO THE STATE OF										
	DRYER EXHAUST			6111 600	¢119 390	10.58**	1.13				
M31_	HEAT RECOVERY	2,748	\$10,597	\$111,688	\$118.389	10,58**	1.13				
	HEAT RECOVERY	2,748	\$10,597	\$111,688	\$118.389	10.58**	1.13				
	HEAT RECOVERY G LEVELS	2,748	\$10,597	\$111,688	\$118.389	10,58**	1.13				
	HEAT RECOVERY  G LEVELS  BUILDING #450										
	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM	2,748	\$10,597 \$34	\$111.688 \$201	\$118.389 \$213	10.58**					
LIGHTIN E1	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM BUILDING #475A	3	\$34	\$201	\$213	. 5.90	. 1.90				
LIGHTIN	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM BUILDING #475A CHAPEL		\$34				. 1.90				
LIGHTIN	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM  BUILDING #475A CHAPEL  BUILDING #475B	3	\$34 \$43	\$201 \$201	\$213 \$213	5.90 4.70	. 1.90				
LIGHTIN E1	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM  BUILDING #475A CHAPEL  BUILDING #475B CHAPEL	3	\$34	\$201	\$213	. 5.90	. 1.90				
E1 E1	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM  BUILDING #475A CHAPEL  BUILDING #475B CHAPEL  BUILDING #475H	3 3 3	\$34 \$43 \$40	\$201 \$201 \$201	\$213 \$213 \$213	5.90 4.70 5.00	. 1.90 2.40 2.20				
LIGHTIN E1 E1	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM  BUILDING #475A CHAPEL  BUILDING #475B CHAPEL	3	\$34 \$43 \$40	\$201 \$201	\$213 \$213	5.90 4.70	. 1.90 2.40 2.20				
E1 E1 E1 E1	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM BUILDING #475A CHAPEL  BUILDING #475B CHAPEL  BUILDING #475H CHAPEL	3 3 3	\$34 \$43 \$40	\$201 \$201 \$201	\$213 \$213 \$213	5.90 4.70 5.00	. 1.90 2.40 2.20				
E1 E1 E1 E1	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM  BUILDING #475A CHAPEL  BUILDING #475B CHAPEL  BUILDING #475H CHAPEL  Z EFFICIENT LIGHTING SYS	3 3 3	\$34 \$43 \$40	\$201 \$201 \$201	\$213 \$213 \$213	5.90 4.70 5.00	. 1.90 2.40 2.20				
E1 E1 E1 E1 ENERGY	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM  BUILDING #475A CHAPEL  BUILDING #475B CHAPEL  BUILDING #475H CHAPEL  7 EFFICIENT LIGHTING SYS  BUILDING #475A	3 3 3 2 TEMS	\$34 \$43 \$40 \$21	\$201 \$201 \$201 \$201	\$213 \$213 \$213 \$213	. 5.90 4.70 5.00 9.50	. 1.90 2.40 2.20 1.20				
E1 E1 E1 E1	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM  BUILDING #475A CHAPEL  BUILDING #475B CHAPEL  BUILDING #475H CHAPEL  Z EFFICIENT LIGHTING SYS	3 3 3	\$34 \$43 \$40 \$21	\$201 \$201 \$201	\$213 \$213 \$213	5.90 4.70 5.00	. 1.9 2.4 2.2 1.2				
E1 E1 ENERGY	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM BUILDING #475A CHAPEL  BUILDING #475B CHAPEL  BUILDING #475H CHAPEL  ( EFFICIENT LIGHTING SYS BUILDING #475A INVESTIGATION	3 3 3 2 TEMS	\$34 \$43 \$40 \$21	\$201 \$201 \$201 \$201	\$213 \$213 \$213 \$213	. 5.90 4.70 5.00 9.50	. 1.90 2.40 2.20 1.20				
E1 E1 E1 E1 E1 E1 ENERGY	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM BUILDING #475A CHAPEL BUILDING #475B CHAPEL BUILDING #475H CHAPEL  CHAPEL  GEFFICIENT LIGHTING SYS BUILDING #475A INVESTIGATION	3 3 3 2 TEMS	\$34 \$43 \$40 \$21	\$201 \$201 \$201 \$201	\$213 \$213 \$213 \$213	. 5.90 4.70 5.00 9.50	. 1.90 2.40 2.20 1.20				
E1 E1 ENERGY	HEAT RECOVERY  G LEVELS  BUILDING #450 CONFERENCE ROOM BUILDING #475A CHAPEL  BUILDING #475B CHAPEL  BUILDING #475H CHAPEL  ( EFFICIENT LIGHTING SYS BUILDING #475A INVESTIGATION	3 3 3 2 TEMS	\$34 \$43 \$40 \$21	\$201 \$201 \$201 \$201	\$213 \$213 \$213 \$213	5.90 4.70 5.00 9.50	1.13 . 1.90 2.40 2.20 1.20				

<sup>\*</sup>TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH

#### **ALL ECO'S REJECTED**

ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGÝ SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
REDUCE	INFILTRATION			r			
	BUILDING #463	4.0	<b>A</b> 40	040.047	644.054	017.40	0.0
A1	SOUTH GATE / VISITORS	12	\$49	\$10,617	\$11,254	217.43	0.0
A 4	BUILDING #464	9	¢40	\$5,549	\$5,882	123.73	0.1
A1	OUTSIDE BARBER SHOP	9	\$42	\$5,549	\$5,662	120.70	0.1
A1	INSIDE BARBER SHOP	256	\$1,061	\$61,405	\$65,089	58.08	0.2
	BUILDING #466	250	ψ1,001	φοτ, του	ψου,σσσ		
A1	CARPENTRY SHOP	1	\$8	\$18,112	\$19,199	4544.00	0.0
	BUILDING #472						
A1	PRINT SHOP / COLLEGE	62	\$265	\$25,015	\$26,516	96.18	0.1
	BUILDING #473						
A1	CLASSIFICATION	12	\$54	\$12,250	\$12,985	215.67	0.0
	BUILDING #475						
A1	ROTUNDA	15	\$59	\$7,865	\$8,337	129.39	0.1
	BUILDING #475A						
A1	INVESTIGATION	93	\$399	\$9,504	\$10,074	23.61	0.6
	BUILDING #475B			40.700	#40 004	151.00	0.1
<u>A1</u>	DINING / LIBRARY	16	\$65	\$9,793	\$10,381	151.20	0.1
A 4	BUILDING #475C	40	0474	¢04.040	\$33,721	186.69	0.0
A1	HSG. UNIT / RECEPTION BUILDING #475D	42	\$171	\$31,812	\$33,721	180.05	0.0
A1	HSG. UNIT / 4-BASE	48	\$195	\$37,748	\$40,013	193.27	0.0
<u>. ^!</u>	BUILDING #475E	40	φ195	• 407,740	φ40,010	. 100.27	
A1	DINING / LAUNDRY / GYM	53	\$146	\$42,102	\$44,628	283.56	0.0
	BUILDING #475F		ψίτο	Ψ12,102	<b>Q</b> 1 1 1 0 1 0 1		
A1	HSG. UNIT	89	\$365	\$37,990	\$40,269	105.02	0.1
	BUILDING #475G		*****				
A1	HSG. UNIT	41	\$169	\$32,708	\$34,670	196.54	0.0
	BUILDING #475H						
A1	MSA / D&A BOARD / TDS	20	. \$85	\$7,563	\$8,017	92.50	0.1
WINDOV	VREPLACEMENT						
40	BUILDING #450	404	4455	201010	400.004	74.60	0.2
A2	MENTAL HYGIENE BUILDING #465	104	\$455	\$34,048	\$36,091	74.60	0.2
A2	INSIDE BARBER SHOP	217	\$892	\$369,241	\$391,395	414.93	0.0
AZ	BUILDING #475	217	\$692	\$309,241	φ391,393	414.55	0.0
A2	ROTUNDA	78	\$317	\$104,902	\$111,196	331.03	0.0
7.11-	BUILDING #475C	70	ψ517	Ψ104,30Z	Ψ111,100	001.00	
A2	HSG. UNIT / RECEPTION	161	\$658	\$208,538	\$221,050	318.52	0.0
	BUILDING #475D		7555	<b>V</b> 200,000			
A2	HSG. UNIT / 4-BASE	237	\$967	\$244,911	\$259,606	254.16	0.0
	BUILDING #475F						
A2	HSG. UNIT	186	\$761	\$244,911	\$259,606	323.81	0.0
	BUILDING #475G						
A2	HSG. UNIT / FEM HSG	164	\$671	\$208,538	\$221,050	312.81	0.0
ATTIO II	ICH ATION						
ALIICIN	ISULATION					<del></del>	
АЗ	BUILDING #475E	40		000 407	\$20.010	187.69	0.0
HO	DINING / LAUNDRY / GYM	40	\$169	\$30,487	\$32,316	187.09	0.0

<sup>\*</sup> TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH

#### ALL ECO'S REJECTED

	ECO	BUILDING NAME	ENERGY SAVINGS MBTU'S/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR
1	VESTIBU	LES						
L	<b>A</b> 5	BUILDING #463 SOUTH GATE / VISITORS	12	\$49	\$88,238	\$93,532	1807.08	0.01
3	SOLAR V	VINDOW SHADING						
١	A6	BUILDING #463 SOUTH GATE / VISITORS	-17	(\$53)	\$2,056	\$2,179	-73.68	-0.37
Ī	A6	BUILDING #464 OUTSIDE BARBER SHOP	-11	(\$26)	\$1,782	\$1,889	-596.00	-0.20
f		BUILDING #472			\$835	\$885	37.41	0.30
ł	A6	PRINT SHOP / COLLEGE   BUILDING #473	18	\$74				
-	A6	CLASSIFICATION BUILDING #475A	-11	\$11	\$2,565	\$2,719	85.80	-0.03
	A6	INVESTIGATION	32	\$406	\$8,020	\$8,501	20.22	0.55
	A6	BUILDING #475B DINING / LIBRARY	6	\$74	\$2,774	\$2,940	37.12	0.30
	A6	BUILDING #475H MSA / D&A BOARD / TDS	5	\$60	\$2,610	\$2,767	42.26	0.26
Ī	EXTERIO	R WALL INSULATION						
	A7	BUILDING #472 PRINT SHOP / COLLEGE	229	\$1,507	\$57,916	\$61,391	54.83	0.28
ŀ		BUILDING #475C		·		•		0.06
L	A7	HSG. UNIT / RECEPTION	154	\$628	\$158,675	\$168,196	253.55	0.06
Г	ARCHITE	CTURAL REPAIRS BUILDING #463						
	A9	SOUTH GATE / VISITORS			\$424	\$449		
	<b>A</b> 9	BUILDING #465 INSIDE BARBER SHOP			\$1,671	\$1,771		
	A9	BUILDING #466 CARPENTRY SHOP			\$582	\$617		
	<b>A</b> 9	BUILDING #472 PRINT SHOP / COLLEGE			\$1,219	\$1,292		
ı		BUILDING #473						
Ì	A9	CLASSIFICATION BUILDING #475			\$2,132	\$2,260		
	A9	ROTUNDA BUILDING #475A			\$13,727	\$14,551		
	A9	INVESTIGATION BUILDING #475E		<del></del>	\$1,221	\$1,294		
I	<b>A</b> 9	DINING / LAUNDRY / GYM			\$50,302	\$53,320		
,	SCHEDU	LE AIR HANDLING EQUIPM	ENT					
	M1	BUILDING #463 SOUTH GATE / VISITORS	10	\$51	\$464	\$492	9.32	0.93
	M1	BUILDING #464 OUTSIDE BARBER SHOP	45		\$8,731	\$9,255	21.85	0.42
١		LB ECONOMIZER CONTROL		4000	ψο, το τ	Ψο,μοσ		
1		BUILDING #463				4	400.00	
	M2	SOUTH GATE / VISITORS BUILDING #464	0	\$3	\$1,459	\$1,547	488.00	0.02
	M2	OUTSIDE BARBER SHOP BUILDING #473	13	\$156	\$1,333	\$1,413	8.85	0.97
	M2	CLASSIFICATION	1	\$7	\$1,333	\$1,413	191.00	0.05
	EXHAUS	ST HEAT RECOVERY						
	M5	COIL LOOP	301	\$953	\$15,352	\$16,273	12.81	0.92
	CIVI	TOOL LOOP	301	া ক্রহত্ত	\$10,352	Ψ10,273	12,01	0.02

<sup>\*</sup>TOTAL PROJECT COST IS CONSTRUCTION COST + 6% SIOH

#### **ALL ECO'S REJECTED**

		BUILDING	ENERGY	ENERGY		TOTAL	SIMPLE	
	ECO	NAME	SAVINGS	SAVINGS	CONSTRUCTION	PROJECT	PAYBACK	SIR
L			MBTU'S/YR	(\$)	COST	COST*	YEARS	
13.14	A A. T	E BUADUADU						
IN	SULAT	E DUCTWORK				T		
	140	THIS ECO IS NOT						
L	M6	NOT COST EFFECTIVE						
-		DI 4117 0001 1110						
CE	NIKAL	L PLANT COOLING						
		ALL BUILDINGS IN THE			244.542	0474 045	100.00	0.05
	M10	USDB FACILITY	220	\$2,737	\$444,542	\$471,215	162.99	0.05
DC	NI ED 1	N ANT MODIFICATIONS						
BC	JILEK F	PLANT MODIFICATIONS						
	1445	ECONOMIZER	000	04.440	400.050	004.000	20.08	0.58
	M15	HEAT RECOVERY	280	\$1,142	\$22,852	\$24,223	20.08	0.36
-	NIVED:	T EDOM STEAM TO HOT W	ATED					
رير	NAFK	T FROM STEAM TO HOT W	AIEK					
	M24	ALL BUILDINGS IN THE USDB FACILITY	14.404	ØE0.004	#604 067	\$672,429	12.24	1.00
	NI24	JUSUB FACILITY	14,464	\$52,024	\$634,367	\$072,429	12.24	1.00
	MVED	T FROM STEAM TO COGEN	IEDATION					
~	NAAEU	ALL BUILDINGS IN THE	IERATION					
	M25	USDB FACILITY		\$58,138	\$1,200,000	\$1,272,000	21.00	
_	MZS	TOSUB PACILITY		\$38,138	\$1,200,000	\$1,272,000	21.00	
DE	CENT	RALIZE HOT WATER SYSTI	=м					
<u> </u>	CENT	BLDGS, 450, 463, 464.	= IVI					
1	M29	466, 467, 468, 472, & 473	243	\$1,296	\$19,599	\$20,775	19.85	0.59
Ь	IVIZS	1400, 407, 408, 472, & 473	243	\$1,290	φ19,399	φ20,773	13.00	0.001
187	ATED L	JEATING HEAT DUMPS						
447	AIERI	IEATING HEAT PUMPS IBUILDING #450				· · · · · ·		
	M39	MENTALHYGIENE	9	6117	\$73,293	\$77,691	656.70	0.01
$\vdash$	MSS	BUILDING #463	9	\$117	\$73,293	\$11,091	030.70	0.01
	M39	1		0100	<b>#50 565</b>	¢56 770	521.87	0.02
$\vdash$	M39	SOUTH GATE / VISITORS	!	\$106	\$53,565	\$56,779	321.07	0.02
	1400	BUILDING #464	46	0400	<b>#FO COF</b>	#60 066	24.46	0.34
-	M39	OUTSIDE BARBER SHOP	16	\$163	\$59,685	\$63,266	34.46	0.34
	1420	BUILDING #465	007	64 545	#no o4 o	641.050	20 11	0.39
$\vdash$	M39	INSIDE BARBER SHOP	307	\$1,342	\$39,012	\$41,353	29.11	0.39
	Mac	BUILDING #472	400	<b>#054</b>	#4 ED COO	\$160.074	189.65	0.06
-	M39	PRINT SHOP / COLLEGE	166	\$851	\$159,692	\$169,274	189.03	0.06
	Mac	BUILDING #473		4010	400.004	en4 407	410.05	0.02
$\vdash$	M39	CLASSIFICATION #475A	17	\$212	\$86,261	\$91,437	410.25	0.02
	1400	BUILDING #475A		00.10	407.400	#400.040	201.60	0.02
$\vdash$	M39	INVESTIGATION	20	\$249	\$97,188	\$103,019	391.68	0.02
	1420	BUILDING #475B		0454	001 000	#64.000	410 27	0.02
-	M39	DINING / LIBRARY	12	\$154	\$61,228	\$64,902	412.37	0.02
	Man	BUILDING #475H	_	0115	046.045	640 700	420.25	0.02
_	M39	IMSA / D&A BOARD / TDS	9	\$115	\$46,915	\$49,730	420.35	0.02
1.14	CHTING	G LEVELS						
<u> </u>	GHING	T					T	
	E1	BUILDING #475A	اد	<b>**</b>	0004	6010	11.80	0.90
$\vdash$	<u></u>	CONFERENCE ROOM	1	\$17	\$201	\$213	11.80	0.90
	E4	BUILDING #475E	,		***	***	15.70	0.70
Ц.,	E1	CONFERENCE ROOM	1	\$13	\$201	\$213	15.70	0.70



i ji				ESOS				
		PROJECT GROUP	ECC	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YPS	SIR
-								
Г		GROUP 1						
		In House Low Cost No Cost						
		III House Low Cost 140 Cost						
	470	Building 470	ECO-A4	17	\$69	\$922	12.65	1.28
		Building 464	ECO-A3	106	\$583	\$3,408	5.54	2.57
			ECO-M26	23	\$92	\$0		
	4/5	Building 475	ECO-IVIZO	20	Ψ32	\$0		
-		Buildings 475C, 475D, 475F, and 475G	ECO-M26	51	\$210	\$0		
		Tunnels	ECO-M26	73	\$299	\$0		
		GROUP 1 TOTALS	E004W20	270	\$1,253	\$4,330	6.09	1.75
		GROUP 1 FUNDING CATEGORY: L			Ψ., <u>.</u> 200			
L		IGHOUP I FUNDING CATEGORY. L	.OVV CC31/1N	0 0001				
Г		GROUP 2						
		Laundry Heat Recovery					]	
		Laundry Heat Necovery					}	
1	474	Wash Water Heat Recovery	ECO-M31	3,871	\$15,742	\$46,459	2.79	4.18
	4/4	GROUP 2 TOTALS	LCC-WS1	3,871	\$15,742	\$46,459	2.79	4.18
-		GROUP 2 FUNDING CATEGORY: F	ECIP	0,011	ψ10,7.2 I			
L		TGHOUP 2 FUNDING CATEGORY. T	LOII					
~ F		GROUP 3						
		Insulate Water Piping						
		modiate Water riping					1	
	475	Castle Building	М30	147	787	\$1,447	2.28	5.11
-	4,0	Pipe Tunnels	M30	55	293	\$481	2.03	5.75
		GROUP 3 TOTALS	11100	202	\$1,080	\$1,928	2.21	5.27
-		GROUP 3 FUNDING CATEGORY: L	OW COST/N	IO COST				
_		10.100.01000						
Γ		GROUP 4						
- 1		Power Plant						
		,						
	474	Outside Testing - Steam Traps	МЗ	1,510	\$6,161	\$17,119	2.63	4.44
		Reduce Steam Pressure	M12	605		\$9,931	3.81	3.06
		Condensate Return System	M14	1,687		\$38,115	5.24	2.23
		Oxygen Trim Controls	M15	3,397		\$39,077	2.67	4.37
	717	GROUP 4 TOTALS	,,,,,	7,199		\$104,242	3.36	3.47
		GROUP 4 FUNDING CATEGORY: (	OSD PIF					
L		TO TOOL AT OND ING OVER COUNTY, C						

, part			E303				
	PROJECT GROUP	ECCO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	GROUP 5 Building 475 Repairs						
1	Attic Insulation - Rotunda Exhaust Heat Recovery	ECO-A3 ECO-M5	142 453	\$578 \$2,130	\$4,868 \$12,909	7.96 6.66	2.03 1.76
475C	Air System Repair Air System Repair	ECO-M11 ECO-M11	273 277	\$1,474	\$1,779 \$1,779	1.51	7.72 7.83
475F	Air System Repair Air System Repair	ECO-M11 ECO-M11	307 247	\$1,323	\$1,779 \$1,779	1.34	8.68 6.99 2.40
475A	Lighting Levels - Chapel Lighting Levels	ECO-E1	3	\$43 \$40	\$213 \$213	4.70 5.00 9.50	2.40 2.20 1.20
	Lighting Levels  Energy Efficient Lighting	ECO-E1 ECO-E2	2 8	\$21 \$100	\$213 \$131 \$25,663	1.24 3.40	9.00 3.41
	GROUP 5 FUNDING CATEGORY: I	PECIP	1,715	\$8,808	\$25,663	. 0.40	9. 17
	GROUP 6 Building 450 Repairs						
	Solar Window Shading	ECO-A6 ECO-E1	36	\$256 \$34	\$2,121 \$213	7.84 5.90	1.66 1.90
450	Lighting Levels GROUP 6 TOTALS GROUP 6 FUNDING CATEGORY:		39	\$290	\$2,334	7.58	1.27
L	GAOOF OF ONDING OATEGOTY:	2011 000 111					
	GROUP 7 Energy Efficient Motors						
	All Buildings in the USDB GROUP 7 TOTALS	ECO-E3	248 248		\$22,185 \$22,185	6.81 6.81	1.64 1.64
	GROUP 7 FUNDING CATEGORY: N	ONE					

#### **ENERGY AND COST SAVINGS**

#### **TOTAL POTENTIAL ENERGY AND COST SAVINGS**

		ENERGY	ENERGY
		SAVINGS	SAVINGS
		MBTU/YR	\$/YR
GROUP 1	IN HOUSE LOW COST/NO COST	270	\$1,253
GROUP 2	LAUNDRY HEAT RECOVERY	3,871	\$15,742
GROUP 3	INSULATE DOM. WATER PIPE	202	\$1,080
GROUP 4	POWER PLANT	7,199	\$29,374
GROUP 5	BUILDING 475 REPAIRS	1,715	\$8,808
GROUP 6	BUILDING 450 REPAIRS	39	\$290
GROUP 7	ENERGY EFFICIENT MOTORS	248	\$3,085

TOTAL	13,544	\$59,632

#### PERCENTAGE OF ENERGY CONSERVED

POTENTIAL ENERGY SAVINGS, MBTU	13,544
EXISTING ENERGY CONSUMPTION, MBTU	55,894
PERCENT ENERGY CONSERVED	24.2%

#### **ENERGY USE AND COST**

	ENERGY	ENERGY
	MBTU/YR	\$/YR
BEFORE ECO IMPLEMENTATION	55,894	\$323,459
AFTER ECO IMPLEMENTATION	42,350	\$263,827

## **GROUP 1**

PROJECT GROUP	ECCO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 1 In House Low Cost No Cost						
470 Building 470 464 Building 464 475 Building 475 Buildings 475C, 475D, 475F, and 475G	ECO-A4 ECO-A3 ECO-M26	17 106 23	\$69 \$583 \$92 \$210	\$922 \$3,408 \$0 \$0 \$0	12.65 5.54	1.2 <sup>3</sup> 2.5
Tunnels	ECO-M26	73 270	\$299 \$1,253	\$0 \$4,330	6.09	1.7

# ECO-A4

DOCK DOOR REPLACEMENT

ENERGY , USING	ANALYSI	ENERGY ANALYSIS WORKSHEET USING	HEET.						
ASHRAE	MODIFIE	<b>ASHRAE MODIFIED BIN METHOD</b>	НОП					1000	N. P. J. A.
BIN	AVG.	BIN	NIS :	EXIST Q1	NEW Q2	EXIST 03	NEW CA	EXIS!	NEW C.C.
TEMP	DB	TEMP	HOURS	U=1.28	U=0.17	OFM.	CFIL.	(CI+C3) * (BIN HBS)	* (BIN HRS)
		68°F	YEAR	Y=04	† O-C	52.98	4.55		
100/104	102		3						
66/56	6		41		٠				
90/94	92		197						
85/89	87		436						
80/84	82		638						
75/79	77		788						
70/74	72		710						
69/69	29	-	717	81.92	10.88	57.48	4.94	99952	11341
60/64	62	9	681	491.52	65.28	344.90	29.62	569602	64627
55/59	57	11	587	901.12	119.68	632.32	54.30	900127	102129
50/54	52	16	584	1310.72	174.08	919.73	78.99	1302584	147792
45/49	47	21	539	1720.32	228.48	1207.15	103.67	1577906	179030
40/44	42	26	580	2129.92	282.88	1494.57	128.36	2102202	238517
35/39	37	31	678	2539.52	337.28	1781.98	153.04	2929979	332436
30/34	32	36	589	2949.12	391.68	2069.40	177.72	2955908	335378
25/29	27	41	347	3358.72	446.08	2356.82	202.41	1983291	225025
20/24	22	46	296	3768.32	500.48	2644.23	227.09	1898115	215361
15/19	17	51	153	4177.92	554.88	2931.65	251.77	1087764	123418
10/14	12	56	77	4587.52	609.28	3219.06	276.46	601107	68202
2/9	7	61	29	4997.12	663.68	3506.48	301.14	569741	64643
0/4	2	99	47	5406.72	718.08	3793.90	325.83	432429	49064
		,		TOTA TOTAL Y	TOTAL EXISTING YEARLY LOAD IN BTU'S TOTAL NEW YEARLY LOAD IN BTU'S TOTAL YEARLY LOAD DIFFERENCE IN BTU'S	YEARLY LOA YEARLY LOA ) DIFFERENC	AD IN BTU'S AD IN BTU'S SE IN BTU'S	19,010,707	2,156,962

Table A4.1

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7 PROJECT NO. & TITLE: 1496									STUDY: USDBAE LCCID 1.035 CENSUS: 2			
FIS	FISCAL YEAR 1990 DISCRETE PORTION NAME: 470A4 ANALYSIS DATE: 03-30-90 ECONOMIC LIFE 25 YEARS PREPARED BY: CRB											
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY C E. SALVAGE F. TOTAL INV	OST ORED VALU	OIT CALC (1) JE COST		-1C)X.9				\$ \$ \$ \$ \$ \$ \$ \$	870. 52. 48. 873. 0. 873.		
2.	ENERGY SAV ANALYSIS DA	INGS	S (+) / COST NNUAL SAV	(-) 'INGS	, UNIT CO	ST & D	ISCOUNTE	SAVINGS				
	FUEL		INIT COST /MBTU(1)	• • • • •	/INGS FU/YR(2)		NUAL \$ VINGS(3)	DISCOUNT FACTOR(4)		COUNTED (INGS(5)		
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$	12.44 .00 .00 4.08 .00		0. 0. 0. 17. 0.	\$ \$ \$ \$	0. 0. 0. 69.	11.16 17.19 17.12 16.15 13.92		0. 0. 0. 1114. 0.		
	F. TOTAL				17.	\$	69.		\$	1114.		
3.	NON ENERGY	Y SA\	/INGS(+) / C	OST(-	)							
		TNU	RRING (+/-) FACTOR (TA ED SAVING/			<b>\1</b> )	11.65		\$ \$	0. 0.		
	C. TOTAL NO	N EN	IERGY DISC	CNUO	TED SAVIN	VGS(+)	/COST(-) (3	A2+3Bd4)	\$	0.		
	A IF 30 B IF 30 C IF 3	AX N 01 IS 01 IS D1B I	ENERGY Q ON ENERGY = OR > 3C G < 3C CALC S = > 1 GO G S < 1 PROJE	Y CAL 60 TO SIR = FO ITE	C (2F5 X ITEM 4 : (2F5+3D EM 4	.33) 1)/1F)=		\$ 368.				
4.	FIRST YEAR	DOLL	AR SAVING	S 2F3	+3A+(3B1	D/(YEA	RS ECONO	MIC LIFE))	\$	69.		
5.	TOTAL NET	OISCO	DUNTED SAY	VINGS	(2F5+3C)	)			\$	1114.		

(SIR)=(5 / 1F)=

SPB=1F/4



6. DISCOUNTED SAVINGS RATIO (IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED)

1.28

12.65

CONSTRUCTION COST ESTIMATE	DATE PREPARED				SHEET OF			
PROJECT		4/2/90 1 1						
USDB ENERGY STUDY								
OCATION FORT LEAVENWORTH, KS			CODE B	(PRELIMINAR)	Y DESIGN)			
ARCHITECT/ENGINEER					CODEC	(FINAL DESIG	iN)	
CLARK RICHARDSON & BISKUDRAWING NO.	JP	ESTIM	ATOR	L	OTHER !	CHECKED BY	Y	
NONE			DLS		ABOR	TOL TOTAL		
ECO-A4 DOCK DOOR REPLACEMENT	NO.	UNIT		TOTAL	PER	TOTAL	COST	
DOCK DOOK REPLACEMENT	UNITS				UNIT			
BUILDING 470								
DEMOLITION	1	EA			50.00	50		\$50
ROLLING DOOP/HARDWARE	1	EA	745.00	745	75.00	75		\$820
	<u> </u>							
						ļ		
		<del> </del>	<del>                                     </del>					
	1							
	-	-						
	+	-	+					
	-	-	1					
								\$870
CONSTRUCTION COST					J.,			

ENG. FORM 150 1AVC-59

# ECO-A3

ATTIC INSULATION

### **ECO-A3 ECONOMIC ANALYSIS**

STEAM CONSUMPTION ELECTRIC CONSUMPTION							
BUILDING NUMBER	BASE ENERGY (THERMS)	ECO-A3 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	ECO-A3 LOAD (KW)	ENERGY SAVINGS (MBTU)	TOTAL SAVINGS (\$)
	(1111						
463	1,577	1,379	20	83,903	82,814	4	\$127
464	2,195	1,311	88	91,802	86,441	18	\$588
472	15,515	15,241	27	234,490	232,543	7	\$194
475	13,619	12,203	142	58,399	58,386	0	\$578
475E	21,657	21,253	40	611,712	611,617	0	\$169
7,30		2.,200		1			\$1,657

	ENER STALLATION & OJECT NO. &	GY CO LOCA		ION IN	VESTME	NT F	PROGR	RAM (EC	IP) ION N	OS. 7		UDY: USDBAE LCCID 1.035 CENSUS: 2
FIS	SCAL YEAR 199 ALYSIS DATE:	90	DIS		PORTIC NOMIC LI				PRE	EPARED	BY:	CRB
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	CTION OST CREDI VALUI	T CALC (1 <i>F</i> E COST		1C)X.9						\$ \$ \$ \$ \$ \$ \$	3215. 193. 177. 3227. 0. 3227.
2.	ENERGY SAV ANALYSIS DA	INGS TE AN	(+) / COST ( INUAL SAV	(-) INGS,	UNIT CO	ST 8	& DISC	OUNTE	O SAV	INGS		
	FUEL		NIT COST MBTU(1)	SAVI MBT	NGS U/YR(2)		ANNU. SAVIN	AL \$ GS(3)		COUNT CTOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00		18. 0. 0. 88. 0.	\$ \$ \$ \$ \$		224. 0. 0. 359. 0.		11.16 17.19 17.12 16.15 13.92		2500. 0. 0. 5798. 0.
	F. TOTAL				106.	\$		583.			\$	8298.
3.	NON ENERGY	/ SAVI	NGS(+) / C	OST(-)								
	A. ANNUAL R	ECUR	RING (+/-) FACTOR (TA					11.65			\$	0.
			D SAVING/			(1)		11.00			\$	0.
	C. TOTAL NO	N EN	ERGY DISC	OUNT	ED SAVIN	1GS	(+) /CC	)ST(-) (3	3A2+3I	Bd4)	\$	0.
	A IF 3D B IF 3D C IF 3I	AX NC )1 IS = )1 IS < D1B IS	ENERGY QI DN ENERGY OR > 3C G 3C CALC S = > 1 GO T < 1 PROJE	CALC O TO I SIR = O ITE	C (2F5 X TEM 4 (2F5+3D M 4	.33) 1)/1	) F)=		\$	2738.		
4.	FIRST YEAR	DOLLA	AR SAVING	S 2F3+	3A+(3B1	D/(Y	EARS	ECONO	MIC LI	IFE))	\$	583.
5.	TOTAL NET D	ISCO	UNTED SAV	/INGS	(2F5+3C)						\$	8298.
6.	DISCOUNTED (IF < 1 PROJE				Y)		(SIR)=	(5 / 1F)=	z	2.57		

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

5.54

CONSTRUCTION COST ESTIMATE			DATE PR		4/2/90		SHEET OF 2 5
(110000)			BASIS FOR ESTIMATE				
USDB ENERGY STUDY OCATION				X	CODE A	(NO DESIGN	COMPLETED)
FORT LEAVENWORTH, KS					CODE B	(PRELIMINAR (FINAL DESIG	Y DESIGN)
ARCHITECT/ENGINEER CLARK RICHARDSON & BISK	110				OTHER (	SPECIFY)	
DRAWING NO.	.Ur	ESTIM.	ATOR			CHECKED B	
NONE	011/	NTITY	I M	DLS IATERIAL	L	ABOR	TOL TOTAL
ECO-A3 ATTIC INSULATION	NO. UNITS	UNIT	PER	TOTAL	PER UNIT	TOTAL	COST
BUILDING 464							
10" BATT INSULATION	2271	SQ FT	0.70	1,590	0.15	341	\$1,93
MOBILIZATION	2271	SQ FT			0.10	227	\$22
					<u>.</u>		
							·
)							
SUBTOTAL				\$1,590		\$568	\$2,1
CONTINGENCY 10%			10%	\$159	10%	\$57	\$2
SUBTOTAL				\$1,749		\$625	\$2,3
WORK COMP,TAX,SOC.SEC.,INS			3.50%	\$61	13.0%	\$81	\$1
DIRECT COST				\$1,810		\$706	\$2,5
OVERHEAD AND PROFIT			25%	6 \$452	25%	s176	\$6
SUBTOTAL				\$2,262		\$882	\$3,1
CONSTRUCTION COST							\$3,1

ENG. FORM 150 1AVC-59

# ECO-M26

# REDUCE HOT WATER TEMPERATURE

	CALCULATION SHEET	DATE Mar-90	SHEET OF			
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION				
LOCATION		X HAND				
ARCHITECT/	ENGINEER CLARK RICHARDSON & BISKUP	ОТН	ER (SPECIFY)			
ECO MEASU		COMPUTED BY RGB	CHECKED BY MAW			

TEST DATA, BTUH LOSS PER LINEAL FOOT REF: Guidlines for Saving Energy in Existing Buildings Federal Energy Administration Office of Energy Conservation and Environment

Tables were developed from fig. 44 of the Guidlines for Saving Energy in Existing Buildings

Ambient Temperature 68° F BTUH Loss per lineal foot of bare pipe

Bare Pipe				
Pipe Size	180° Water	160° Water	140° Water	120° Water
3/4"	85	70	55	39
1"	105	85	66	46
1-1/4"	126	104	81	57
1-1/2"	150	121	95	67
2"	171	140	110	80
2-1/2"	205	169	133	94

Table M26-1a

Ambient Temperature 68° F BTUH Loss per lineal foot of insulated pipe

1/2" Fiberglass Insulation

1/2" Fibergla	ss Insulation			
Pipe	180°	160°	140°	120°
Size	Water	Water	Water	Water
3/4"	20	15	11	88
1"	21	17	12	9
1-1/4"	26	20	16	11
1-1/2"	30	24	19	13
2*	36	30	23	15
2-1/2"	45	35	27	20

Table M26-1b

	CALCULATION SHEET	DATE SHEET OF 2 5			
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION			
COCATION		X HAND COMPUTER			
ARCHITECT/	ENGINEER CLARK RICHARDSON & BISKUP	CONTRACTOR BID OTHER (SPECIFY)			
ECO MEASU		COMPUTED BY CHECKED BY RGB MAW			

TEST DATA, BTUH LOSS PER LINEAL FOOT REF: Guidlines for Saving Energy in Existing Buildings Federal Energy Administration Office of Energy Conservation and Environment

Tables were developed from fig. 44 of the Guidlines for Saving Energy in Existing Buildings

Ambient Temperature 68° F BTUH Loss per lineal foot of bare pipe

Bare Pipe

bare ripe					
Pipe	Btuh loss	Btuh loss	Btuh Savings	Hours per Year	\$ Savings per L.F.
Size	@ 180°	@ 140°	Savings	1 Cai	Del L.I .
3/4"	85	55	30	4380	\$0.70
1"	105	66	39	4380	\$0.91
1-1/4*	126	81	45	4380	\$1.05
1-1/2"	150	95	55	4380	\$1.29
2"	171	110	61	4380	\$1.43
2-1/2"	205	133	72	4380	\$1.68

Table M26-2a

Ambient Temperature 68° F BTUH Loss per lineal foot of insulated pipe

1/2" Fiberglass Insulation

Pipe Size	Btuh loss @ 180°	Btuh loss @ 140°	Btuh Savings	Hours per Year	\$ Savings per L.F.
3/4"	20	15	5	4380	\$0.12
1"	22	17	5	4380	\$0.12
1-1/4"	26	20	6	4380	\$0.14
1-1/2"	30	24	6	4380	\$0.14
2"	36	30	6	4380	\$0.14
2-1/2"	45	35	10	4380	\$0.23

Table M26-2b

	CALCULATION SHEET	DATE Mar-90	SHEET OF 3 5
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCUL  X HAND COMPUTE	ER .
ARCHITECT/	ENGINEER CLARK RICHARDSON & BISKUP	CONTRAC	(SPECIFY)
ECO MEASU		COMPUTED BY RGB	CHECKED BY MAW

#### REDUCED DOMESTIC HOT WATER TEMPERATURE

Tm = (Q1\*T1) + (Q2\*T2) / (Q1+Q2)

Assumption: Tm = 110  $T1 = 40^{\circ}$ 

T2= X

Tm = mixed water temperature T1= temperature of fl (Cold Water Temp.)

Tm (°)	T1 (°)	Q1 (Gal.)	T2 (°)	Q2 (Gal.)
110.00	40.00	68.18	180.00	31.82
110.00	40.00	66.67	170.00	33.33
110.00	40.00	65.00	160.00	. 35.00
110.00	40.00	63.16	150.00	36.84
110.00	40.00	61.11	140.00	38.89
110.00	40.00	58.82	130.00	41.18
110.00	40.00	56.25	120.00	43.75

Table M26-3

	CALCULATION SHEET	DATE Mar-90	SHEET OF 5
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCUL	ATION
LOCATION		X HAND COMPUTI	
ARCHITECT/	ENGINEER CLARK RICHARDSON & BISKUP	CONTRAC	CTOR BID (SPECIFY)
ECO MEASU		COMPUTED BY RGB	CHECKED BY MAW

TEST DATA, BTUH LOSS PER LINEAL FOOT REF: Guidlines for Saving Energy in Existing Buildings Federal Energy Administration Office of Energy Conservation and Environment

Tables derived from Tables M26-2a and M26-2b Length of pipe estimated from field inspection and plans.

Building 475E

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	Feet of Insulated	\$ Savings per FT.	\$ Savings Year
3/4"		\$0.70		\$0.12	\$0
1"		\$0.91		\$0.12	\$0
1-1/4"	100	\$1.05		\$0.14	 \$105
1-1/2"	20	\$1.29	20	\$0.14	\$29
2"		\$1.29		\$0.14	\$0

Energy Savings = \$134.00

lunnels betv	veen building	468, 466, 4	67, 463, 46		
Pipe	Feet of	\$ Savings	Feet of	\$ Savings	\$ Savings
Size	Bare Pipe	per Ft.	Insulated	per FT.	Year
3/4"		\$0.70		\$0.23	\$0
1"		\$0.91	180	\$0.23	\$41
1-1/4"	60	\$1.05	90	\$0.28	\$88
1-1/2"	55	\$1.29	355	\$0.28	\$170
2*		\$1.29		\$0.28	\$0

\$299.00 Energy Savings =

	CALCULATION SHEET	DATE	SHEET OF
PROJECT	USDB	Mar-90 BASIS FOR CALCU	LATION 5
LOCATION	ENERGY SAVINGS OPPORTUNITY SURVEY	X HAND	TER
ARCHITECT/	ENGINEER CLARK RICHARDSON & BISKUP		ACTOR BID R (SPECIFY)
ECO MEASU		COMPUTED BY RGB	CHECKED BY MAW

TEST DATA, BTUH LOSS PER LINEAL FOOT

REF: Guidlines for Saving Energy in Existing Buildings

Federal Energy Administration Office of Energy Conservation and Environment

Tables derived from Tables M26-2a and M26-2b Length of pipe estimated from field inspection and plans.

Building 475

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	Feet of Insulated	\$ Savings per FT.	\$ Savings Year
3/4"	20101120	\$0.70		\$0.12	\$0
1"		\$0.91		\$0.12	\$0
1-1/4"	60	\$1.05		\$0.14	\$63
1-1/2"	20	\$1.29	20	\$0.14	\$29
2"		\$1.29		\$0.14	\$0

Energy Savings = \$92.00

Buildings 475C .475D, 475F, 475G

Pipe Size	Feet of Bare Pipe	\$ Savings per Ft.	Feet of Insulated	\$ Savings per FT.	\$ Savings Year
3/4"		\$0.70		\$0.23	\$0
1"		\$0.91		\$0.23	\$0
1-1/4*	200	\$1.05	0	\$0.28	\$210
1-1/2"		\$1.29		\$0.28	\$0
2"		\$1.29		\$0.28	\$0

Energy Savings = \$210.00

PR FIS	STALLATION & OJECT NO. & SCAL YEAR 19	RGY C LOC TITLE 90	CONSERVAT ATION: FOF E: 1496 DIS	OST ANALYSIS TON INVESTME RT LEAVENWOR CRETE PORTIC ECONOMIC L	NT PR RTH - ON NAM	OGRAM (EC USDB REG 1E: GROUF	10N NOS. 7		JDY: USDBAE LCCID 1.035 CENSUS: 2
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY E. SALVAGE F. TOTAL INV	OST CREE VALU	OIT CALC (1/ JE COST					****	4085. 245. 225. 4100. 0. 4100.
2.	ENERGY SAV	/INGS	S (+) / COST NNUAL SAV	(-) 'INGS, UNIT CO	ST & D	ISCOUNTE	O SAVINGS		
	FUEL		JNIT COST J/MBTU(1)	SAVINGS MBTU/YR(2)		INUAL \$ VINGS(3)	DISCOUNT FACTOR(4		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	18. 0. 0. 110. 0.	\$ \$ \$ \$ \$ \$	224. 0. 0. 449. 0.	8.69 12.42 12.2 11.6 10.3	2 1 7	1947. 0. 0. 5240. 0.
	F. TOTAL			128.	\$	673.		\$	7187.
3.	NON ENERG	Y SAV	/INGS(+) / C	OST(-)					
	A. ANNUAL F		RRING (+/-) FACTOR (T/	ADIE A)		9.11		\$	0.
				COST (3A X 3A	<b>\1</b> )	3.11		\$	0.
	C. TOTAL NO	ON EN	IERGY DISC	OUNTED SAVIN	1GS(+)	/COST(-) (3	3A2+3Bd4)	\$	0.
	(1) 25% M A IF 30 B IF 30 C IF 3	IAX N D1 IS D1 IS D1B I	ON ENERGY = OR > 3C G < 3C CALC S = > 1 GO T	UALIFICATION OF CALC (2F5 X TO TO ITEM 4 SIR = (2F5+3D TO ITEM 4 CT DOES NOT	.33) 1)/1F)=		\$ 2372	-	
4.	FIRST YEAR	DOLL	AR SAVING	S 2F3+3A+(3B1	D/(YEA	RS ECONO	MIC LIFE))	\$	673.
5.	TOTAL NET	DISCO	DUNTED SAV	/INGS (2F5+3C)	)			\$	7187.
6.	DISCOUNTED (IF < 1 PROJE				(S	R)=(5 / 1F)=	1.7	5	

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

6.09

T ALL DINCESCHILLS	BER SUFFIX BLANK	69 70 71 72 73 74 75 75 77 78	16 14 14 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	NUMBER SUFFIX BLA			in building 470 is	Appr be los	d. Heat Will ater piping if the		ATION	TELEPHONE	SOURCE OF FUNDS		O ORECT  AUTOMATIC REIMB.	L ronden keime.					FORWARD TO KEYPUNCH AFTE COMPLETION OF "FORWARD FC APPROVAL" BLOCK
	SHOAT JOB DESCRIPTION NUMBER	9 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74	IMIDIX TOLVIE M IE IN C. ISI I I I P. D. 14	NUMBER SUFFIX NUMBER SUFFIX	75/35/37/38/39/40/31/42/31/42/42/45/46/42/42/42/42/42/42/42/42/42/42/42/42/42/	ESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED	the leaky, poorly insulated dock door in	lost by conduction and ion BTU's per will	g 464 if the attic is not insulated. e to be wasted from domestic hot wat	ture is not reduced.	PERSON TO CALL FOR ADDITIONAL INFORMATION	ORGANIZATION	APPROVED FOR DESIGN		·	SIGNATURE	REMARKS				GREEN -F
RK REQUEST - XFA, XFB, XFC as proposent agency is the Office of the	OHS .	39 40 41 42 43 44 45 46 47 48 49 50 51 52 53	OW L ICIOIS IT F II BUILDING/FACILITY	NUMBER SUFFIX	41 (42)(43)(44)(45)(45)(47)(48)(49) P (0 14 17 15) [F.	HW 3818023	If the	This will 106	building continue	temperature		NAME		W	FACILITIES ENGINEER	OATE		FORWARDED TO	A MO	19 20 21 27 27 27 29 20	WHITE CORIGINAL PROPINK
Forus	TRANS 2 RED SERIAL 2 W NUMBER SUFFIX YR MO DA OTHER FUND CITATION	: 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 35 37 38 39 40 41	DOCUMENT NUMBER SUILDING/FACILITY SUILDING/FACILITY SUILDING/FACILITY	SUFFIX NUMBER SUFFIX NUMBER, SUFFIX NUMBER, SUFFIX NUMBER		ESCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED	Lace the dock door in building 470. Its poor condition and high heat	to the attic in building 464.	domestic hot water temperature from 185 % to 140 % in buildings 4/5, 475C, 475D, 475F, and 475G. This cost-free measure reduces the amount o	heat radiated from piping to the surroundings.	REQUESTER INFORMATION	ME ORGANIZATION TELEPHONE NO. SIGNATURE	TVACCORY GCS CG VAGCS	RECOMMENDED ENVIRONMENTAL INPACT - ESTIMATED COST WORK TO BE FROM ACTION	ENVISONMENTAL FUNDED S 4,330   IN-HOUSE CONSIDERATIONS WC X S 4,330   SECK-HELP WC L S   CONTRACT	UNFUNDED 5 197 CT TOTAL 54.527	INDIEST TENDOUSE	D OOCUMENT NUMBER	REO SERIAL Y E ACTION TAKEN MO DA	SIGNATURE OF APPROVAL AUTHORITY	IM 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED. GROUP 1 - PAGE 14

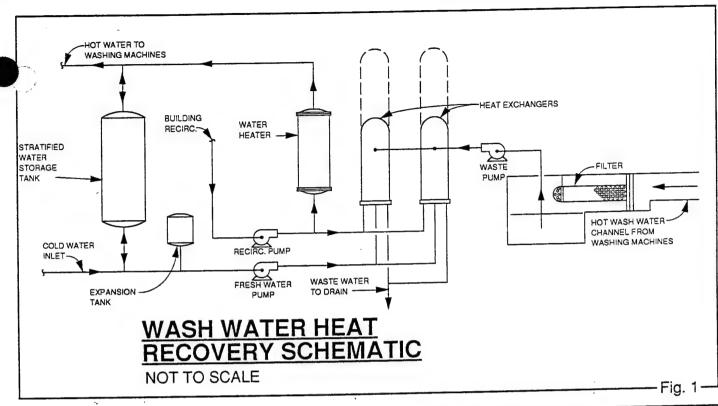
### GROUP 2

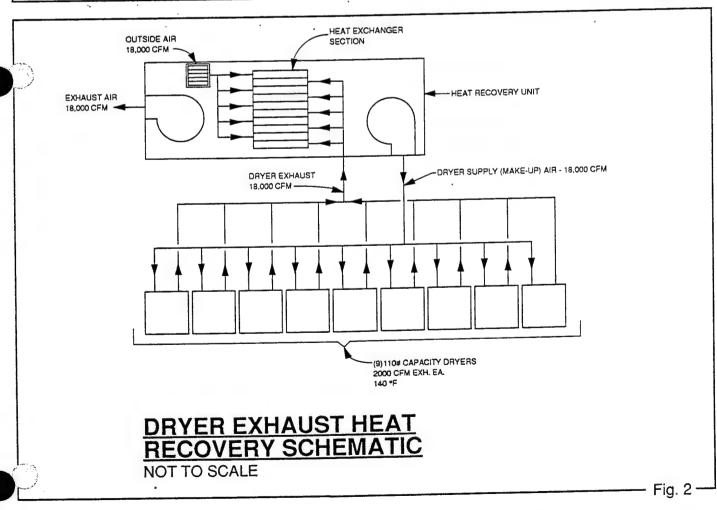
#### ENERGY CONSERVATION ANALYSIS ESOS

PROJECT GROUP	ECCO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 2 Laundry Heat Recovery						
474 Wash Water Heat Recovery	ECO-M31	3,871	\$15,742	\$46,459	2.79	4.18
GROUP 2 TOTALS GROUP 2 FUNDING CATEGORY:	DECID	3,871	\$15,742	\$46,459	2.79	4.18

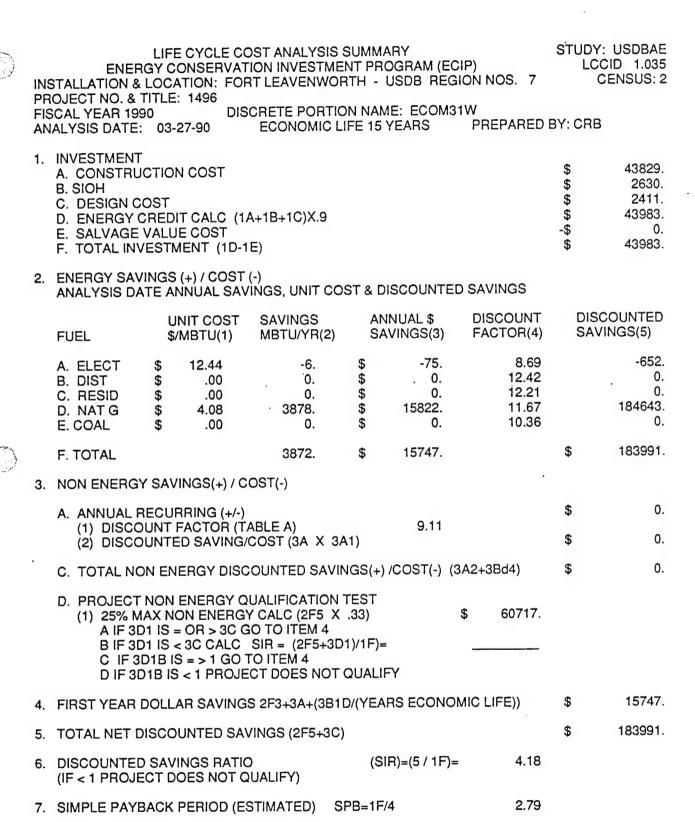
## ECO-M31

# HEAT RECOVERY FOR LAUNDRY





	CALCULATION SHEET	ATE Mar-90	SHEET OF
PROJECT	USDB	ASIS FOR CALCULA	
PROJECT	ENERGY SAVINGS OPPORTUNITY SURVEY		
OCATION	EHERIOT ONVINCE OF TOTAL CONTINUES.	X HAND	
,	FORT LEAVENWORTH, KANSAS	COMPUTE	
ARCHITECT/I		CONTRAC	
	CLARK RICHARDSON & BISKUP		(SPECIFY)
CO MEASU	the control of the co	OMPUTED BY	CHECKED BY MAW
	ECO-M31 WASH WATER HEAT RECOVERY	BMS	IVIAVV
	GIVEN:		
	GIVEN.		_
	HOT WATER USE TEMP., °F	160	
	AVERAGE COLD WATER INLET TEMPERATURE, °F	50	
	GALLONS WATER/LB. OF LAUNDRY	2.5	<b>5</b>   .
	PERCENT OF WASTE WATER THAT IS HOT	70	,
	HOURS OF OPERATION PER WEEK	40	
	ELECTRICITY COST, DOLLARS/MBTU	12.44	ş <del>.</del>
	GAS COST IN DOLLARS/MBTU	4.08	
	BOILER SEASONAL EFFICIENCY, %	74	
	BUILER SEASONAL LITTUILINGT, 78		
	CALCULATED WASTE WATER TEMP., °F	127	,
	WASTE WATER TEMP USED IN ANALYSIS, °F	124	
	TATOLE TATLETTEM GOLD HAVE LOOP		
	BASED ON HEAT EXCHANGER MANUFACTURER'S		
	PERFORMANCE DATA FOR 30 GPM UNIT:		
			7
	SHELL SIDE TEMPERATURE, °F IN/OUT	124 / 91	
	TUBE SIDE TEMPERATURE, °F IN/OUT	50 / 96	7
		0.070	
	STEAM HEAT RECOVERED, MBTU/YR:	2,870 3,878	
	GAS HEAT RECOVERED, MBTU/YR:	3,070	•
	(2) 30 GPM UNITS ARE REQUIRED.		
	(m) 50 01 11 0111 0 111 11 11 11 11 11 11 11		
	PUMP ENERGY CALCULATION FOR THIS ECO		
		60	ิจ
	FRESH WATER PUMP CAPACITY, GPM:		
	FRESH WATER PUMP HEAD, FT. W:	38	
	FRESH WATER PUMP EFFICIENCY, %:	65	
	WASTE WATER PUMP CAPACITY, GPM:	84	
	WASTE WATER PUMP HEAD, FT. W:	10	
	WASTE WATER PUMP EFFICIENCY, %:	65	
		000	
	FRESH WATER PUMP POWER CONSUMPTION, WATTS:	662	
	FRESH WATER PUMP ENERGY USE, MBTU/YEAR:	4.70	4
		. 04	
	WASTE WATER PUMP POWER CONSUMPTION, WATTS:	244	
	WASTE WATER PUMP ENERGY USE, MBTU/YEAR:	1.73	7
	TOTAL DUMP ENERGY METHAD	6.43	3
	TOTAL PUMP ENERGY, MBTU/YR.:	0.40	<b>a</b>
	NET ENERGY SAVINGS FOR WASH WATER H.R., MBTU	/YR.: 3,87	2
	N== = = = = = = = = = = = = = = = = = =	15,74	2
	NET ENERGY SAVINGS, \$/YR:	1.0,14	-





CONSTRUCTION COST ESTIMAT	ΓE		DATE PR		4/2/90		SHEET	OF 1
PROJECT				BASIS FOR E	STIMATE			
USDB ENERGY STUDY UOCATION FORT LEAVENWORTH, KS				x	CODE	(NO DESIGN	RY DESIG	
ARCHITECT/ENGINEER CLARK RICHARDSON & BISKUI	Þ					(FINAL DES (SPECIFY)	SIGN)	
DRAWING NO.		ESTIM	ATOR	I,	<u> </u>	CHECKED BY		
NONE	OLI	ANTITY	T N/	BMS ATERIAL	1	ABOR	MAW TO	TAL
ECO-M31	NO. UNITS	UNIT	PER	TOTAL	PER UNIT	TOTAL		OST
WASH WATER HEAT RECOVERY SYSTEM								
HELICAL COIL HEAT EXCHANGER	2	EA	\$9,500	\$19,000	\$1,010	\$2,020		\$21,020
FRESH WATER PUMP (59 GPM, 50 FT. HD.)	1	EA	\$1,070	\$1,070	\$180	\$180		\$1,250
WASTE WATER PUMP (94 GPM, 10 FT. HD.)	1	EA	\$500	\$500	\$40	\$40		\$540
STRATIFIED WATER STORAGE TANK	1	EA	\$6,500	\$6,500	\$355	\$355		\$6,855
2" SCHEDULE 40 STEEL PIPING & ACCESSORIES	100	LF	\$3	\$289	\$6	\$555		\$844
SUBTOTAL				\$27,359		\$3,150		\$30,509
CONTINGENCY 10%			10%	\$2,736	10%	\$315		\$3,051
SUBTOTAL				\$30,095		\$3,465		\$33,560
WORK COMP,TAX,SOC.SEC.,INS			3.50%	\$1,053	13.0%	\$450		\$1,500
DIRECT COST				\$31,148		\$3,915		\$35,060
OVERHEAD AND PROFIT			25%	\$7,787	25%	\$979		\$8,766
SUBTOTAL				\$38,935		\$4,894		\$43,829
CONSTRUCTION COST								\$43,829

ENG. FORM 1AVC-59



	LIFE CYCLE CONSERVATION & LOCATION: FOR OUTPOON STALLATION & TITLE: 1496	TION INVEST	MENT PF	OGRAM (E	CIP) GION NOS. 7	ST	UDY: USDBAE LCCID 1.035 CENSUS: 2
FIS	CAL YEAR 1990 DIS ALYSIS DATE: 03-27-90	SCRETE POR ECONOMIC			P#2 PREPARED	BY:	CRB
1.	INVESTMENT A. CONSTRUCTION COST B. SIOH C. DESIGN COST D. ENERGY CREDIT CALC (1 E. SALVAGE VALUE COST F. TOTAL INVESTMENT (1D-					\$ \$ \$ \$ \$ \$	43829. 2630. 2411. 43983. 0. 43983.
2.	ENERGY SAVINGS (+) / COST ANALYSIS DATE ANNUAL SAV	(-) VINGS, UNIT (	COST & I	DISCOUNTE	D SAVINGS		
	FUEL UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT \$ 12.44 B. DIST \$ .00 C. RESID \$ .00 D. NAT G \$ 4.08 E. COAL \$ .00	-6. 0. 0. 3878. 0.	\$ \$ \$ \$ \$	-75. 0. 0. 15822. 0.	8.69 12.42 12.21 11.67 10.36		-652. 0. 0. 184643. 0.
	F. TOTAL	3872.	\$	15747.		\$	183991.
3.	NON ENERGY SAVINGS(+) / C	COST(-)					
	A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (T (2) DISCOUNTED SAVING	ABLE A)	3A1)	9.11		\$	0. 0.
	C. TOTAL NON ENERGY DISC	COUNTED SA	VINGS(+	)/COST(-) (	3A2+3Bd4)	\$	0.
	D. PROJECT NON ENERGY C (1) 25% MAX NON ENERGY A IF 3D1 IS = OR > 3C C B IF 3D1 IS < 3C CALC C IF 3D1B IS = > 1 GO D IF 3D1B IS < 1 PROJ	Y CALC (2F5 GO TO ITEM 4 SIR = (2F5+ TO ITEM 4	X .33) ; 3D1)/1F)		\$ 60717.		
4.	FIRST YEAR DOLLAR SAVING	SS 2F3+3A+(3	B1D/(YE/	ARS ECONO	MIC LIFE))	\$	15747.
5.	TOTAL NET DISCOUNTED SA	VINGS (2F5+3	3C)			\$	183991.
6.	DISCOUNTED SAVINGS RATI (IF < 1 PROJECT DOES NOT		(\$	SIR)=(5 / 1F):	= 4.18		
7.	SIMPLE PAYBACK PERIOD (E	STIMATED)	SPB=1	=/4	2.79		



おしょう - FORWARO TO KEYPUNCH AFTE COMPLETION OF "FORWARD FC APPROVAL" BLOCK S CAN と はいのまんましまし If this heat recovery unit is not installed, approximately O O O DECT.

AUTOMATIC REIMB.

PUNOED REIMB. 3,878 million BTU's per year from washwater will continue SOURCE OF FUNDS SUFFIX BUILDING/FACILITY SUILDING/FACILITY RSEMUN PERSON TO CALL FOR ADCITIONAL INFORMATION NUMBER SUFFIX ヨナイロ ; ところにい BUILDINGIFACILITY DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED WHITE (ORIGINAL) - PROJECT FILE COPY - FORWARO TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK ORGANIZATION APPROVED FOR DESIGN いいいないい ALIANOGINI HEALT RECONETIVE SUPFIX いにいてよいない SUILDING/FACILITY FACILITIES ENGINEERING WORK REQUEST - XFA, XF3, XFC Fogineers. For use of this form, see AR 420-17 and DA Pam 420-6; the proponent agency is the Office of the Chief of Engineers. SHORT JOB DESCRIPTION REMARKS to be wasted SUFFIX BUILDING/FACILITY DESIGN ESTIMATOR MO OA MO OA PACILITIES ENGINEER FORWARDED TO いこくて NUMBER 7-40 rent location of the USDB laundry facility. Hot, dirty washwater from ch heat could be recovered for preheat of fresh washwater is currently a counterflow, helical coil heat exchanger in building 474, the ¥OE' SUFFIX SIGNATURE OF APPROVAL AUTHORITY BUILDINGFACILITY C SELF-HELP CONTRACT TROOP WORK TO SE PERFORMED OTHER FUND CITATION GROUP 2 - PAGE 7 TELEPHONE NO. SIGNATURE いて社のに出 , 46,459 ESTIMATED COST SUFFIX vi い しゅついつせいつ BUILDING/FACILITY FUNDED ナロエベト x V .¥0 ∩ Ó FORWARD FOR APPROVAL 9,1 0,1 3,1 No. NUMBER EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED. APPROVAL ACTION DATE Š REDUESTER INFORMATION CONSIDERATOR CONSIDERATIONS 5 16 17 18 **√** ENVIRONMENTAL INPACT K Y ロタて足 COMPLETED C EIS/EIA INITIATEO Š ION AND JUSTIFICATION OF WORK TO SE ACCOMPLISHED SUFFIX SUFFIX BUILDINGIFACILITY **BUILDING/FACILITY** 0 - 0(528990000 P1014171415 ACTION TAKEN A - APPROVED とのになれいいよりにの 200 NUMBER [3] Ø NUMBER Ø C APPROVAL
COISAPPROVAL RECOMMENDED ACTION ing wasted to drain. LAPE TYPE DOCUMENT NUMBER BEG SERIAL Y FE 7 8 9 10 11 12 13 3471 SERIAL Y SERIAL . NUMBER BERIAL といれのおいつい ロ 4283 DO DE DO

## **GROUP 3**

#### ENERGY CONSERVATION ANALYSIS ESOS

,						
PROJECT GROUP	ECC	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	T		· · · · · · · · · · · · · · · · · · ·			
GROUP 3 Insulate Water Piping						
475 Castle Building	M30	147		\$1,447 \$481	2.28 2.03	5.11 5.75
Pipe Tunnels GROUP 3 TOTALS	M30_	202		\$1,928	2.21	5.27
GROUP 3 FUNDING CATEGORY:	LOW COST/					

## ECO-M30

# DOMESTIC WATER PIPE INSULATION

	CALCULATION SHEET	DATE Mar-90	SHEET OF
PROJECT	USDB ENGROV SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCUL	ATION
LOCATION	ENERGY SAVINGS OPPORTUNITY SURVEY	X HAND COMPUT	ER
ARCHITECT	/ENGINEER CLARK RICHARDSON & BISKUP	CONTRA	CTOR BID (SPECIFY)
ECO MEASU		COMPUTED BY RGB	CHECKED BY MAW

TEST DATA, BTUH LOSS PER LINEAL FOOT REF: Guidlines for Saving Energy in Existing Buildings Federal Energy Administration Office of Energy Conservation and Environment

Table was developed from fig. 44 of the Guidlines for Saving Energy in Existing Buildings

Ambient Temperature 68° F Domestic Hot Water Temperature 180°

Pipe Size	BTUH Loss Bare Pipe	BTUH Loss Insulated	BTUH Savings	Hours per Year	\$ Savings per L.F.
3/4"	85	19	66	4380	\$1.54
1"	105	23	82	4380	\$1.92
1-1/4"	126	26	100	4380	\$2.34
1-1/2"	150	31	119	4380	\$2.78
2"	171	37	134	4380	\$3.13
2-1/2"	250	45	205	4380	\$4.79

	CALCULATION SHEET	DATE Mar-90	SHEET OF
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCUL	ATION
LOCATION	ENERGY ON WINGS OF THE WAY TO SHOULD	X HAND COMPUT	
ARCHITECT/	ENGINEER CLARK RICHARDSON & BISKUP		CTOR BID (SPECIFY)
ECO MEASU		COMPUTED BY RGB	CHECKED BY MAW

TEST DATA, BTUH LOSS PER LINEAL FOOT REF: Guidlines for Saving Energy in Existing Buildings Federal Energy Administration Office of Energy Conservation and Environment

Tables derived from Tables M26-2a and M26-2b Length of pipe estimated from field inspection and plans.

Castle Buildings

Castle Buildin	145		
Pipe	Feet of	\$ Savings	\$ Savings
Size	Bare Pipe	per Ft.	Year
3/4"	80	\$1.54	\$123
1"		\$1.92	\$0
1-1/4"	260	\$2.34	\$608
1-1/2"	20	\$2.78	\$56
2"		\$3.13	\$0

Energy Savings = \$787.00

Pipe Tunnels

ripe fullifiers			
Pipe	Feet of	\$ Savings	\$ Savings
Size	Bare Pipe	per Ft.	Year
3/4"		\$1.54	\$0
1"		\$1.92	\$0
1-1/4"	60	\$2.34	\$140
1-1/2"	55	\$2.78	\$153
2"		\$3.13	\$0

Energy Savings = \$293.00

PR	STALLATION & OJECT NO. & T	GY C LOCA FITLE	ONSERVAT ATION: FOF :: 1496 DIS	OST ANALYSIS S ION INVESTME RT LEAVENWOF CRETE PORTIC	NT PRI ITH - N NAN	OGRAM (EC USDB REG ME: ECOM30	ION NOS. 7		JDY: USDBAE LCCID 1.035 CENSUS: 2
AN.	ALYSIS DATE:	03-	-30-90	ECONOMIC LI	FE 15	YEARS	PREPARE	) BA: (	CHB
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	CTIO OST CRED VALU	OIT CALC (1/ JE COST					***	1365. 82. 75. 1370. 0. 1370.
2.	ENERGY SAV ANALYSIS DA	INGS TE A	S (+) / COST NNUAL SAV	(-) 'INGS, UNIT CO	ST & D	ISCOUNTE	SAVINGS		
	FUEL		JNIT COST J/MBTU(1)	SAVINGS MBTU/YR(2)		INUAL \$ VINGS(3)	DISCOUNT FACTOR(4		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 147. 0.	00000000	0. 0. 0. 600.	8.69 12.42 12.21 11.67 10.36		0. 0. 0. 7002. 0.
	F. TOTAL			147.	\$	600.		\$	7002.
3.	NON ENERGY	Y SA\	/INGS(+) / C	OST(-)					
	A. ANNUAL F	RECU	RRING (+/-)					\$	0.
	(1) DISCO (2) DISCO	TAU(	FACTOR (T. ED SAVING/	ABLE A) COST (3A X 3A	(1)	9.11		\$	0.
	C. TOTAL NO	N EN	NERGY DISC	OUNTED SAVIN	1GS(+)	/COST(-) (3	3A2+3Bd4)	\$	0.
	(1) 25% M A IF 30 B IF 30 C IF 3	AX N 01 IS 01 IS D1B I	ION ENERG' = OR > 3C G < 3C CALC IS = > 1 GO	UALIFICATION Y CALC (2F5 X GO TO ITEM 4 SIR = (2F5+3D TO ITEM 4 CCT DOES NOT	.33) 1)/1F)=		\$ 2311		
4.	FIRST YEAR	DOLL	AR SAVING	S 2F3+3A+(3B1)	O/(YEA	RS ECONO	MIC LIFE))	\$	600.
5.	TOTAL NET	osco	DUNTED SAY	VINGS (2F5+3C)				\$	7002.
6.	DISCOUNTED (IF < 1 PROJE				(S	IR)=(5 / 1F)=	5.11		

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

2.28

INS	ENER TALLATION & DJECT NO. & T	GY C	ONSERVATI ATION: FOR 1496		ENT PRO DRTH - 1	JSDB REG	110N 1403. 7	-	JDY: USDBAE LCCID 1.035 CENSUS: 2
FIS	CAL YEAR 199 ALYSIS DATE:	0	DIS	CRETE PORT ECONOMIC	LIFE 15	YEARS	PREPAREI	DBY: (	CRB
	INVESTMENT A. CONSTRUCT B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	OST CRED VALU	IT CALC (1/					****	454. 27. 25. 455. 0. 455.
2.	ENERGY SAV ANALYSIS DA	INGS TE A	(+) / COST NNUAL SAV	(-) INGS, UNIT C	OST & D	ISCOUNTE	D SAVINGS		
	FUEL		INIT COST /MBTU(1)	SAVINGS MBTU/YR(2		INUAL \$ .VINGS(3)	DISCOUNT FACTOR(4		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 55. 0.	\$ \$ \$ \$ \$ \$	0. 0. 0. 224. 0.	8.6 12.4 12.2 11.6 10.3	2 1 7	0. 0. 0 2614. 0.
	F. TOTAL			55.	\$	224.		\$	2614.
3.	NON ENERG	Y SAV	/INGS(+) / C	OST(-)					0
	A. ANNUAL F (1) DISCO (2) DISCO	TALIC	FACTOR (T	ABLE A) COST (3A X	3A1)	9.11		\$	
	C. TOTAL NO	ON EI	NERGY DISC	COUNTED SA	VINGS(+)	/COST(-)	(3A2+3Bd4)	\$	0.
	A IF 31 B IF 31 C IF 3	IAX N D1 IS D1 IS	ION ENERG = OR > 3C ( < 3C CALC IS = > 1 GO	Y CALC (2F5 30 TO ITEM 4 SIR = (2F5+	X .33) : 3D1)/1F):		\$ 863	3.	
4.	FIRST YEAR	DOLI	_AR SAVING	S 2F3+3A+(3	B1D/(YE/	ARS ECON	OMIC LIFE))	\$	224.
5.	TOTAL NET	OISC	OUNTED SA	VINGS (2F5+	3C)			\$	2614.
6.	DISCOUNTE (IF < 1 PROJ	D SA' ECT I	VINGS RATI DOES NOT (	O QUALIFY)	(\$	SIR)=(5 / 1F	)= 5.7	75	
7.	SIMPLE PAY	BAC	( PERIOD (E	STIMATED)	SPB=1	<del>-</del> /4	2.0	)3	

CONSTRUCTION COST ESTIMA		DATE PR	EPARED			SHEET OF	
PROJECT			<u> </u>	BASIS FOR E	STIMATE		<u> </u>
USDB ENERGY STUDY LOCATION FORT LEAVENWORTH, KS				x	CODE	A (NO DESIGI B (PRELIMINA C (FINAL DES	N COMPLETED) RY DESIGN)
ARCHITECT/ENGINEER CLARK RICHARDSON & BISKI	υP				OTHER	(SPECIFY)	
DRAWING NO.		ESTIM	ATOR	R.G.B.		CHECKED B.	M.A.W.
Castle Buildings	QUA	NTITY		ATERIAL		ABOR	TOTAL
1/2" FIBERGLASS PIPE INSULATION W/ ALL SERVICE JACKET	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
3/4" PIPE	80	L.F.	\$0.87	\$69.60	\$1.44	\$115.20	\$184.80
1-1/4" PIPE	260	L. F.	\$1.01	\$262.60	\$1.57	\$408.20	\$670.80
1-1/2" PIPE	20	L. F.	\$1.10	\$22.00	\$1.57	\$31.40	\$53,40
			·				
		·		•			
L	ļ						
	-						
	<u> </u>						
SUBTOTAL				\$354		\$555	\$909
CONTINGENCY 10%			\$0.10	\$35	10%	\$55	\$90
SUBTOTAL				\$389		\$610	\$999
WORK COMP, TAX, SOC. SEC., INS			\$0.04	\$14	13.0%	\$79	\$93
DIRECT COST			ļ	\$403		\$689	\$1,092
OVERHEAD AND PROFIT	_		\$0.25	\$101	25%	\$172	\$273
SUBTOTAL				\$504		\$861	\$1,365
CONSTRUCTION COST ENG. FORM 150			<u></u>				\$1,365

ENG. FORM 1AVC-59

CONSTRUCTION COST ESTIM	ATE		DATE PR	PARED			SHEET OF 2
PROJECT				BASIS FOR ES	STIMATE		
USDB ENERGY STUDY LOCATION FORT LEAVENWORTH, KS				x	CODE	A (NO DESIGN B (PRELIMINA C (FINAL DES	N COMPLETED) RY DESIGN) IGN)
ACHITECT/ENGINEER CLARK RICHARDSON & BISK	(UP					(SPECIFY)	
DRAWING NO.		ESTIM	TOR	R.G.B.		CHECKED BY	M.A.W.
Pipe Tunnels	QUA	ANTITY	M	ATERIAL		ABOR	TOTAL COST
1/2" FIBERGLASS PIPE INSULATION W/ ALL SERVICE JACKET	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	0051
1-1/4* PIPE	60	L.F.	\$1.01	\$60.60	\$1.57	\$94.20	\$154.80
1-1/2" PIPE	<b>5</b> 5	L. F.	\$1.10	\$60.50	\$1.57	\$86.35	\$146.85
	-						
						,	
							•
				6101		\$181	\$302
SUBTOTAL			\$0.10	\$121 \$12	10%		
CONTINGENCY 10%			\$0.10	\$133	1078	\$199	
SUBTOTAL WORK COMP,TAX,SOC.SEC.,INS			\$0.04		13.0%		
DIRECT COST				\$138		\$225	\$363
OVERHEAD AND PROFIT			\$0.25	\$35	25%	\$56	\$91
SUBTOTAL		ļ		\$173		\$281	\$454
CONSTRUCTION COST ENG. FORM 150							\$454

ENG. FORM 1AVC-59

PRO	TALLATION & I DJECT NO. & T CAL YEAR 199	GY C LOCA ITLE	ONSERVATI ATION: FOR : 1496 DISC	ST ANALYSIS S ON INVESTMEN T LEAVENWOR CRETE PORTIO ECONOMIC LI	VT P TH N NA	ROGRAM (EC - USDB REC AME: GROUF	21ON 2 #3	NOS. 7		IDY: USDBAE LCCID 1.035 CENSUS: 2
	INVESTMENT A. CONSTRUC B. SIOH C. DESIGN CC D. ENERGY C E. SALVAGE F. TOTAL INV	OST RED VALU	IT CALC (1 <i>F</i> JE COST						\$ \$ \$ \$ \$ \$ \$	1819. 109. 100. 1825. 0. 1825.
2.	ENERGY SAVI	INGS TE A	(+) / COST ( NNUAL SAV	(-) INGS, UNIT COS	ST &	DISCOUNTE	D SA	VINGS		
	FUEL	L	INIT COST /MBTU(1)	SAVINGS MBTU/YR(2)	,	ANNUAL \$ SAVINGS(3)	D	ISCOUNT ACTOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 202.	\$ \$ \$ \$ \$	0. 0. 0. 824. 0.		8.69 12.42 12.21 11.67 10.36		0. 0. 0. 9616. 0.
	F. TOTAL			202.	\$	824.			\$	9616:
3.	NON ENERGY	/ SAV	/INGS(+) / C	OST(-)						
	A. ANNUAL R	UNT	FACTOR (TA	ABLE A)		9.11			\$	0. 0.
	(2) DISCO	UNT	ED SAVING/	COST (3A X 3A					\$	0.
	C. TOTAL NO	N E	NERGY DISC	OUNTED SAVIN	1GS	(+) /COST(-)	(3A2-	+3Bd4)	\$	0.
	(1) 25% M A IF 3E B IF 3E C IF 3	AX N 01 IS 01 IS D1B	ION ENERG' = OR > 3C G < 3C CALC IS = > 1 GO	UALIFICATION Y CALC (2F5 X GO TO ITEM 4 SIR = (2F5+3D TO ITEM 4 ECT DOES NOT	.33) 1)/11	F)=	\$	3173.		
4.	FIRST YEAR	DOL	LAR SAVING	S 2F3+3A+(3B1	D/(Y	EARS ECON	OMIC	; LIFE))	\$	824.
5.	TOTAL NET	OISC	OUNTED SA	VINGS (2F5+3C	)				\$	9616.
6.	DISCOUNTED	D SA ECT	VINGS RATION OF CO	O QUALIFY)		(SIR)=(5 / 1F	·)=	5.27		

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

2.21

- FORWARD TO KEYPUNCH AFTE COMPLETION OF "FORWARD F. APPROVAL" SLOCK BLANK ☐ OIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB. 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 25 25 25 27 28 29 30 31 32 33 32 35 37 38 39 40 41 42 43 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 75 77 77 8 water piping, while approximately 55 million BTU's per year is wasted from pipe tunnel piping. In addition, more water TELEPHONE SOURCE OF FUNDS Energy will continue to be wasted from the exposed piping million BTU's per year is wasted from Castle domestic hot will be consumed due to lower point-of-use temperatures. BUILDING/FACILITY Currently, approximately 147 BUILDING/FACILITY NUMBER PERSON TO CALL FOR ADDITIONAL INFORMATION NUMBER SUFFIX GREEK BUILDING/FACILITY DESCAIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED WHITE (ORIGINAL) – PROJECT FILE COPY PINK – FORWARD TO ACTION" BLOCK OF "APPROVAL ACTION" BLOCK APPROVED FOR DESIGN ORGANIZATION NUMBER AII in IS in il raitle, Wialtielr, (Più IDI) in gr SUFFIX SIGNATURE to surrounding spaces. BUILDING/FACILITY SHORT JOB DESCRIPTION NUMBER REMARKS SUFFIX BUILDING/FACILITY 19 20 21 2223 24 25 26 DESIGN ESTIMATOR FACILITIES ENGINEER FORWARDED TO アカスの DATE NUMBER USDB ₹OK! SUFFIX insulation to existing uninsulated domestic hot water piping in This will result in less heat loss from the water to SIGNATURE OF APPROVAL AUTHORITY BUILDING/FACILITY ☐ IN-HOUSE CONTRACT TROOP WORK TO BE PERFORMED OTHER FUND CITATION GROUP 3 - PAGE 9 TELEPHONE NO. SIGNATURE NUMBER \$1,928 8 ENVIRONMENTAL IMPACT | ESTIMATED COST SUFFIX BUILDING/FACILITY UNFUNDED FUNDED TOTAL FORWARD FOR APPROVAL WO K w N PIUS DIB1x 1 1 2 1 0 1 3 1 ď WC . NUMBER EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED. APPROVAL ACTION Š REQUESTER INFORMATION A © ENVIRONMENTAL ©NSIDERATIONS 15 16117 18 ۵ DATE K K COMPLETED C EIS/EIA Š O SCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED SUFFIX SUFFIX BUILDING/FACILITY BUILDING/FACILITY ambient spaces and less water waste. D - DISAPPROVED ACTION TAKEN ORGANIZATION A - APPROVED õ  $\boxtimes$ NUMBER  $\boxtimes$ **E**() NUMBER O APPROVAL RECOMMENDED TYPE 7 Y F DOCUMENT NUMBER FY DOCUMENT NUMBER DOCUMENT NUMBER SERIAL ' SERIAL NUMBER piping tunnels. 8 9 10 11 SERIAL NUMBER 7 9 ROVING AUTHORITY 4283 a c 9 EQ 80 FORM 1 AUG 78 SHANGE 4 CHANGE O 8/ u. Appra CODE 17 ۷ u RANS ZS III

FACILITIES ENGINEERING WORK REQUEST — XFA, XFB, XFC ise AR 420—17 and DA Pam 420—6; the proponent agency is the Office of the Chief of Engineers.

For use of this form.

## GROUP 4

#### ENERGY CONSERVATION ANALYSIS ESOS

.7							
	PROJECT GROUP	ECCO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
	GROUP 4 Power Plant						
474 Reduce 474 Condens	Testing - Steam Traps Steam Pressure sate Return System Trim Controls	M3 M12 M14 M15	1,510 605 1,687 3,397		\$17,119 \$9,931 \$38,115 \$39,077	2.63 3.81 5.24 2.67	4.44 3.06 2.23 4.37
GROUP	4 TOTALS 4 FUNDING CATEGORY: OS		7,199	\$29,374	\$104,242	3.36	3.47

## ECO-M3

SERVICE STEAM PIPING AND TRAPS

SHEET OF DATE **CALCULATION SHEET** March, 1987 BASIS FOR CALCULATION PROJECT USDB **ENERGY SAVINGS OPPORTUNITY SURVEY** HAND CATION COMPUTER CONTRACTOR BID ARCHITECT/ENGINEER OTHER (SPECIFY) **CLARK RICHARDSON & BISKUP** CHECKED BY COMPUTED BY ECO MEASURE MAW **TGD** STEAM TRAP PROGRAM - OWNER TESTING

COST OF STEAM AT FORT LEAVENWORTH - USDB

ENTHALPY OF WATER AT 160° F. = ENTHALPY OF STEAM AT 120 PSIG = SYSTEM EFFICIENCY =

128 BTU/LBM 1,192 BTU/LBM 74%

NATURAL GAS COST = HEAT CONTENT OF NAT. GAS =

\$4.08 MCF 1,000,000 BTU/MCF

 $[(1192-128) \times $4.08) / (0.74 \times 1,000)]$ 

\$5.87 PER THOUSAND LBS. OF STEAM

COST OF INSPECTING TRAPS AFTER TEST VALVES ARE INSTALLED.

ASSUMING AN AVERAGE OF 50 TRAPS PER DAY 8 HOURS PER DAY.

8 MH

\$36.75 PER HOUR =

\$294 PER DAY

\$294

50 TRAPS PER DAY =

\$5.88 PER TRAP

COST OF INSTALLING TEST VALVES ON EACH TRAP =

\$137

SAVINGS FROM TRAP INSPECTION

USING 100 TRAPS AS A BASE WITH A 10% FAILURE RATE; 350 LB/HR F&T TRAP

COST OF INSPECTING TRAPS ONCE DURING THE HEATING SEASON

100 X \$5.88 =

\$588 PER YEAR

NUMBER OF TRAPS FAILED

100 X 10% =

10 TRAPS

COST OF REPAIRING TRAPS

10 X \$145 =

\$1,450 PER YEAR

TOTAL COST OF INSPECTING AND REPAIRING TRAPS

\$2,038 PER YEAR

65 lbs/hr x 4380 hrs/yr x 0.5 (sys. modulation factor) = 142,350 LBS. OF STEAM PER YEAR

142,350 x (1192-128) / 1,000,000 =

151 MBTU / YEAR / TRAP

151 x \$5.87 =

\$886 PER TRAP / YEAR

ENERGY LOST DUE TO FAILED TRAPS

10 X 151 =

1510 MBTU'S PER YEAR

COST OF STEAM LOST DUE TO FAILED TRAPS

10 X \$886 =

\$8,860 PER YEAR

INITIAL INVESTMENT FOR TEST VALVES

\$13,700 100 X \$137 =

CONSTRUCTION COST

\$2.038 + \$13,700 =

\$15,738

OF SHEET DATE **CALCULATION SHEET** 1 March, 1987 BASIS FOR CALCULATION **PROJECT** USDB **ENERGY SAVINGS OPPORTUNITY SURVEY** HAND ATION COMPUTER CONTRACTOR BID ARCHITECT/ENGINEER OTHER (SPECIFY) **CLARK RICHARDSON & BISKUP** CHECKED BY COMPUTED BY **ECO MEASURE** MAW STEAM TRAP PROGRAM - OUTSIDE TESTING TGD

#### COST OF STEAM AT FORT LEAVENWORTH - USDB

ENTHALPY OF WATER AT 160° F. = ENTHALPY OF STEAM AT 120 PSIG = SYSTEM EFFICIENCY = 128 BTU/LBM 1,192 BTU/LBM 74%

NATURAL GAS COST = HEAT CONTENT OF NAT. GAS =

\$4.08 MCF 1,000,000 BTU/MCF

[(1192-128) x \$4.08) / (0.74 x 1,000)]

\$5.87 PER THOUSAND LBS. OF STEAM

#### COST OF INSPECTING TRAPS USING AN OUTSIDE TESTING SERVICE.

ASSUMING AN AVERAGE OF 50 TRAPS PER DAY, 8 HOURS PER DAY. THE COST IS A FLAT FEE OF \$500 PER DAY.

\$500/50 TRAPS = \$10 PER TRAP

COST OF INSTALLING TEST VALVES ON EACH TRAP =

\$137

#### SAVINGS FROM TRAP INSPECTION

USING 100 TRAPS AS A BASE WITH A 10% FAILURE RATE; 350 LB/HR F&T TRAP

COST OF INSPECTING TRAPS ONCE DURING

100 X \$10 =

\$1,000 PER YEAR

THE HEATING SEASON

NUMBER OF TRAPS FAILED

100 X 10% =

10 TRAPS

COST OF REPAIRING TRAPS

10 X \$145 =

\$1,450 PER YEAR

TOTAL COST OF INSPECTING AND REPAIRING TRAPS

\$2,450 PER YEAR

65 lbs/hr x 4380 hrs/yr x 0.5 (sys. modulation factor) =

142,350 LBS. OF STEAM PER YEAR

142,350 x (1192-128)/1,000,000 =

151 MBTU / YEAR / TRAP

151 x \$5.87 =

\$886 PERTRAP/YEAR

**ENERGY LOST DUE TO FAILED TRAPS** 

10 X 151 =

1510 MBTU'S PER YEAR

COST OF STEAM LOST DUE TO FAILED TRAPS

10 X \$886 =

\$8,860 PER YEAR

INITIAL INVESTMENT FOR TEST VALVES

 $100 \times $137 = $13,700$ 

CONSTRUCTION COST

\$2,450 + \$13,700 = \$16,150

PR FIS	ENERGETALLATION & TOUCH	GY C LOCA TTLE 0	ONSERVATI ATION: FOR : 1496 DIS	OST ANALYSIS S ION INVESTME IT LEAVENWOF CRETE PORTIC ECONOMIC LI	NT PR RTH - ON NAM	OGRAM (EC USDB REG ME: ECOM3	OWN:	S. 7	TING	JDY: USDBAE LCCID 1.035 CENSUS: 2
		00-	20-30	20011011110 2						
1.	INVESTMENT A. CONSTRUCE B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	OST RED VALU	IT CALC (1 <i>F</i> IE COST						***	15738. 944. 866. 15793. 0. 15793.
2.	ENERGY SAV ANALYSIS DA	INGS TE A	(+) / COST NNUAL SAV	(-) INGS, UNIT CO	ST & [	DISCOUNTE	IVAS C	NGS		
	FUEL		INIT COST /MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)		OUNT TOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 1510. 0.	\$\$\$\$\$	0. 0. 0. 6161. 0.		8.69 12.42 12.21 11.67 10.36		0. 0. 0. 71899. 0.
	F. TOTAL			1510.	\$	6161.			\$	71899.
3.	NON ENERGY	'SAV	/INGS(+) / C	OST(-)						
	A. ANNUAL R	ECUI	RRING (+/-) FACTOR (T/	ARIFA)		9.11			\$	0.
	(2) DISCO	UNTE	ED SAVING/	COST (3A X 3A	<b>A1</b> )				\$	0.
	C. TOTAL NO	N EN	ERGY DISC	OUNTED SAVIN	NGS(+	)/COST(-) (3	3A2+3B	d4)	\$	0.
	(1) 25% M. A IF 3D B IF 3D C IF 3I	AX No. 1 IS : 1	ON ENERG\ = OR > 3C G < 3C CALC S = > 1 GO T	UALIFICATION 7 CALC (2F5 X O TO ITEM 4 SIR = (2F5+3D TO ITEM 4 CT DOES NOT	.33) 1)/1F):		\$	23727.		
4.	FIRST YEAR [	OLL	AR SAVING	S 2F3+3A+(3B1	D/(YE/	ARS ECONO	MIC LIF	E))	\$	6161.
5.	TOTAL NET D	ISCC	UNTED SAV	/INGS (2F5+3C)					\$	71899.
6.	DISCOUNTED (IF < 1 PROJE				(5	SIR)=(5 / 1F)=	:	4.55		

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

PF FI	ENER STALLATION 8 ROJECT NO. & SCAL YEAR 19 IALYSIS DATE	RGY C & LOC TITLE 990	ONSERVAT ATION: FOI E: 1496 DIS	CRETE POF	MENT PROVINCE OF THE PROVINCE	OGRAM (ECUSDB REC	SION NOS. 7 B - OUTSIDE T	L ESTING	
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY E. SALVAGE F. TOTAL IN	JCTIO COST CRED VALU	OIT CALC (1. JE COST		9			***	16150. 969. 888. 16206. 0. 16206.
2.	ENERGY SAV	VINGS ATE A	S (+) / COST NNUAL SAV	(-) 'INGS, UNIT	COST & D	ISCOUNTE	D SAVINGS		
	FUEL		INIT COST /MBTU(1)	SAVINGS MBTU/YR(		INUAL \$ .VINGS(3)	DISCOUNT FACTOR(4		SCOUNTED AVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	8.69 12.42 12.21 11.67 10.36		0. 0. 0. 71899. 0.					
	F. TOTAL			1510.	\$	6161.		\$	71899.
3.	NON ENERG	Y SAV	'INGS(+) / C	OST(-)					
	A. ANNUAL F		RRING (+/-) FACTOR (T/	ARIFA)		9.11		\$	0.
				COST (3A X	3A1)	3.11		\$	. 0.
	C. TOTAL NO	ON EN	ERGY DISC	OUNTED SA	VINGS(+)	/COST(-) (3	3A2+3Bd4)	\$	0.
	A IF 30 B IF 30 C IF 3	IAX NO D1 IS = D1 IS = D1B IS	ON ENERGY = OR > 3C G < 3C CALC S = > 1 GO T	/ CALC (2F5 O TO ITEM 4 SIR = (2F5+	X .33) 4 -3D1)/1F)=	-Y	\$ 23727.		
4.	FIRST YEAR	DOLL	AR SAVING	S 2F3+3A+(3	B1D/(YEA	RS ECONO	MIC LIFE))	\$	6161.
5.	TOTAL NET	oisco	UNTED SAV	/INGS (2F5+	3C)			\$	71899.
6.	DISCOUNTED (IF < 1 PROJE				(SI	R)=(5 / 1F)=	4.44		
7.	SIMPLE PAY	BACK	PERIOD (ES	STIMATED)	SPB=1F/	4	2.63		

CONSTRUCTION COST ESTIM	ATE		DATE PR	EPARED			SHEET OF
PROJECT				BASIS FOR E	STIMATE		
USDB ENERGY STUDY CATION FORT LEAVENWORTH, KS ARCHITECT/ENGINEER				x	CODE	B (PRELIMINA C (FINAL DES	N COMPLETED) ARY DESIGN) SIGN)
CLARK RICHARDSON & BISK DRAWING NO.	.UP	ESTIM	ATOR		OIRER	(SPECIFY)	Υ
	I QUA	ANTITY	l N	TGD IATERIAL	l	ABOR	TOTAL
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
INSTALL TEST VALVE (PER TRAP)							
CREW 1 STEAM FITTER, 1 APPRENTICE							
DISCONNECT EXISTING PIPE	1.00	мн	\$22.27	\$22	\$20.00	\$20	\$42
INSTALL TEE AND TEST LINE	0.75	МН	\$22.27	\$17	\$5.40	\$4	\$21
INSTALL GLOBE VALVE	0.75	мн	\$22.27	\$17	\$17.10	\$13	\$30
	_						
	<u> </u>						
			· ·				
SUBTOTAL				\$56		\$37	\$93
CONTINGENCY 10%			10%	\$6	10%	\$4	\$10
SUBTOTAL				\$62		\$41	\$103
WORK COMP, TAX, SOC. SEC., INS			3.50%	\$2	13.0%	\$5	\$7
DIRECT COST				\$64		\$46	\$110
OVERHEAD AND PROFIT			25%	\$16	25%	\$11	\$27
SUBTOTAL				\$80		\$57	\$137
CONSTRUCTION COST PER TRAP							\$137

ENG. FORM 150 1AVC-59

## ECO-M12

REDUCE STEAM DISTRIBUTION PRESSURE

	CALCULATION SHEET	DATE	SHEET OF
		Mar-90	1 1
PROJECT	USDB	BASIS FOR CALCUL	ATION
	<b>ENERGY SAVINGS OPPORTUNITY SURVEY</b>		
LOCATION		X HAND	
	STEAM PLANT	COMPUTE	
ARCHITECT/E	NGINEER	CONTRAC	
	CLARK RICHARDSON & BISKUP		(SPECIFY)
ECO MEASUR		COMPUTED BY	CHECKED BY
	ECO M12	TGD	MAW

STEAM PRESSURE	ENTHALPY BTU/LB. OF STEAM	SYSTEM EFFICIENCY	STEAM COST PER 1000 LBS.	ESTIMATED ANNUAL SAVINGS
120 PSIG	1,192.4	74.000%	\$5.754	NONE
115 PSIG	1,191.7	74.094%	\$5.742	\$326
110 PSIG	1,191.0	74.188%	\$5.731	\$624
105 PSIG	1,190.4	74.282%	\$5.721	\$896
100 PSIG	1,189.6	74.376%	\$5.709	\$1,222
95 PSIG	1,188.8	74.470%	\$5.698	\$1,520
90 PSIG	1,188.0	74.564%	<b>\$5.686</b> .	\$1,846
85 PSIG	1,187.2	74.658%	\$5.675	\$2,145
80 PSIG	1,186.3	74.752%	\$5.663	\$2,470

AVERAGE STEAM USE FOR SPACE HEATING: 74,375 LBS PER DAY

ANNUAL ENERGY SAVINGS (AT 80 PSIG):

605 MBTU'S PER YEAR

SYSTEM EFFICIENCY CALCULATED FROM:

IMPROVING BOILER EFFICIENCY BY S.G. DUKELOW

SPONSORED BY KANSAS STATE UNIVERSITY AND KANSAS ENERGY OFFICE

CHAPTER 6: EFFECT OF BOILER STEAM PRESSURE ON FLUE GAS TEMPERATURE AND BOILER EFFICIENCY

CONSTRUCTION COST ESTIMA	ATE		DATE PR	EPARED			SHEET OF 1 1
PROJECT			L	BASIS FOR E	STIMATE		
USDB ENERGY STUDY OCATION FORT LEAVENWORTH, KS				x	CODE	(PRELIMINA	
ARCHITECT/ENGINEER  CLARK RICHARDSON & BISK	UP					(SPECIFY) CHECKED BY	
DRAWING NO. NONE		ESTIM		TGD			MAW
		NTITY		IATERIAL		ABOR TOTAL	TOTAL COST
ECO-M12	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	0031
SCHEDULE 40 STEEL PIPE 5" DIAMETER	85	LF	\$18	\$1,530	\$18	\$1,530	\$3,06
90° ELBOWS	4	EA	\$113	\$452	\$68	\$272	\$72
TEES	1 1	EA	\$194	\$194	\$116	\$116	\$31
BUTTERFLY VALVES	2	EA	\$208	\$416	\$115	\$230	\$64
2" INSULATION / 5" DIAMETER PIPE	154	LF	\$6	\$924	\$3	\$462	\$1,38
GASKET AND BOLT SETS	10	EA	\$13	\$130	\$8	\$80	\$21
•.							·
	-						
	-						
	<del> </del>						
SUBTOTAL				\$3,646		\$2,690	\$6,33
CONTINGENCY 10%			10%	\$365	10%	\$269	\$63
SUBTOTAL				\$4,011		\$2,959	\$6,97
VORK COMP,TAX,SOC.SEC.,INS			3.50%	\$140	13.0%	\$385	\$52
DIRECT COST	-			\$4,151		\$3,344	\$7,49
OVERHEAD AND PROFIT			25%	\$1,038	25%	\$836	\$1,87
SUBTOTAL				\$5,189		\$4,180	\$9,36
CONSTRUCTION COST							\$9,36

ENG. FORM 1AVC-59

PR FIS	ENER STALLATION & OJECT NO. & SCAL YEAR 199 IALYSIS DATE:	GY C LOC TITLE	CONSERVAT ATION: FOF E: 1496 DIS	OST ANALYSIS S ION INVESTMEI RT LEAVENWOR CRETE PORTIO ECONOMIC LI	NT PF ITH - N NA	ROGRAM (EC USDB REC ME: ECOM1	SION N 2	OS. 7		CUDY: USDBAE LCCID 1.035 CENSUS: 2
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY C E. SALVAGE F. TOTAL INV	OST OST VALI	OIT CALC (1/ JE COST						\$ \$ \$ \$ \$ \$ \$	9369. 562. 515. 9401. 0. 9401.
2.	ENERGY SAV ANALYSIS DA	INGS	S (+) / COST NNUAL SAV	(-) 'INGS, UNIT COS	ST & 1	DISCOUNTE	D SAV	INGS		
	FUEL		JNIT COST S/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)		COUNT CTOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	***	12.44 .00 .00 4.08 .00	0. 0. 0. 605.	\$\$\$\$ \$\$	0. 0. 0. 2468. 0.		8.69 12.42 12.21 11.67 10.36		0. 0. 0. 28802. 0.
	F. TOTAL			605.	\$	2468.			\$	28802.
3.	NON ENERGY	/ SAV	/INGS(+) / C	OST(-)						
	A. ANNUAL P		RRING (+/-) FACTOR (T/	ARIF AV		9.11			\$	0.
	(2) DISCO	UNT	ED SAVING/	COST (3A X 3A	1)	0.77			\$	0.
	C. TOTAL NO	N EN	NERGY DISC	OUNTED SAVIN	IGS(+	)/COST(-) (	3A2+3I	Bd4)	\$	0.
	(1) 25% M A IF 3D B IF 3D C IF 3I	AX N 01 IS 01 IS 01B I	ON ENERGY = OR > 3C G < 3C CALC S = > 1 GO T	UALIFICATION T CALC (2F5 X TO TO ITEM 4 SIR = (2F5+3D1 TO ITEM 4 CT DOES NOT (	.33) 1)/1F)		\$	9505.		
4.	FIRST YEAR I	OOLL	AR SAVING	S 2F3+3A+(3B1E	)/(YE	ARS ECONO	MIC LI	FE))	\$	2468.

(SIR)=(5/1F)=

SPB=1F/4



5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)

(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED)

6. DISCOUNTED SAVINGS RATIO

3.06

3.81

## **ECO-M14**

SERVICE CONDENSATE RETURN SYSTEM

	CALCULATION SHEET	DATE	SHEET OF
		Mar-90	1 1
PROJECT	USDB	BASIS FOR CALCULATION	NO
	ENERGY SAVINGS OPPORTUNITY SURVEY		
LOCATION		X HAND	
		COMPUTER	
ARCHITECT/ENGINEER	IGINEER	CONTRACTOR BID	BID
	CLARK RICHARDSON & BISKUP	OTHER (SPECIFY)	CIFY)
<b>ECO MEASURE</b>		COMPUTED BY	CHECKED BY
SERVICE CON	SERVICE CONDENSATE RETURN SYSTEM ECO-M14	TGD	MAW

LINI	AMB	INSUL	MIND	PIPE	INSULA	INSULATION CHARACTERISTIC PIPE	ARACTE	RISTIC	FLOW SPEC		EMISS FINAL TOTAL	FINAL	TOTAL
TEMP	TEMP	THICK	VEL	DIA	T 1	T 1 CON1 T2	T2	CON 2 LEN	#/HR HEAT	HEAT		TEMP HL	H
212	75	2	_	1 8.625	460	ı	0.5 100 0.25	0.25	6200	700 6200 1.05		0.9 201.1	71,040
212	75	0.001		1 8.625	460		0.5 100 0.25	0.25	6200	700 6200 1.05		154.9	0.9 154.9 371,640

	CALCULATION SHEET	DATE	SHEET OF
	•	Mar-90	1 1 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCUL	ATION
OCATION	ENERGY ON VINGO OF CHICAGO	X HAND COMPUT	
ARCHITECT/	ENGINEER CLARK RICHARDSON & BISKUP		CTOR BID (SPECIFY)
ECO MEASU		COMPUTED BY TGD	CHECKED BY

120 PSIG STEAM PRESSURE:

1192.4 BTU/LB. ENTHALPY

155°F CONDENSATE RETURN TEMPERATURE:

123 BTU/LB. ENTHALPY

201°F CONDENSATE RETURN TEMPERATURE:

169 BTU/LB. ENTHALPY

SYSTEM EFFCIENCY:

74%

AVERAGE DAILY STEAM CONSUMPTION:

148,750 LBS.

STEAM LOAD SERVED BY WEST TUNNEL:

50%

DAYS PER YEAR:

365

(1192.4 - 123) - (1192.4 - 169) / 0.74

62.16 BTU/LB.

(62.16 X 148,750 X .5 X 365)/1,000,000

1,687 MBTU/YEAR

	PF FI	ENER STALLATION & ROJECT NO. & SCAL YEAR 199 JALYSIS DATE:	GY LOO TITL 90	.E: 1496 DIS	TION INVEST RT LEAVEN CRETE POF	TMENT PF WORTH - RTION NAI	ROGRAM (EC USDB REC ME: ECOM1	310N NO 14	S. 7		CUDY: USDBAE LCCID 1.035 CENSUS: 2
	1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY C E. SALVAGE F. TOTAL INV	OST OST ORE VAL	- DIT CALC (1/ UE COST		9				\$\$\$\$\$\$	35958. 2157. 1978. 36084. 0. 36084.
	2.	ENERGY SAV ANALYSIS DA				COST & D	SCOUNTE	D SAVIN	GS		
		FUEL		UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(		NNUAL \$ AVINGS(3)	DISCO FACTO	OUNT OR(4)		DISCOUNTED SAVINGS(5)
		A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 1687. 0.	\$\$\$\$\$\$\$	0. 0. 0. 6883. 0.	•	8.69 12.42 12.21 11.67 10.36		0. 0. 0. 80325.
1		F. TOTAL			1687.	\$	6883.			\$	80325.
	3.	NON ENERGY	SA	VINGS(+) / C	OST(-)						
		A. ANNUAL R		JRRING (+/-) FACTOR (TA	ARIFA)		9.11			\$	0.
				ED SAVING/		3A1)	3.11			\$	0.
		C. TOTAL NO	N EI	NERGY DISC	OUNTED SA	VINGS(+)	/COST(-) (3	3A2+3Bd	4)	\$	0.
		A IF 3D B IF 3D C IF 3D	AX N 1 IS 1 IS 11B	I ENERGY OI ION ENERGY = OR > 3C G < 3C CALC IS = > 1 GO T S < 1 PROJE	' CALC (2F5 O TO ITEM 4 SIR = (2F5+ 'O ITEM 4	X .33) 4 -3D1)/1F)=		\$ 26	6507.		
	4.	FIRST YEAR	OLI	_AR SAVINGS	S 2F3+3A+(3	B1D/(YEA	RS ECONO	MIC LIFE	E))	\$	6883.
	5.	TOTAL NET D	SC	DUNTED SAV	'INGS (2F5+	3C)				\$	80325.
	6.	DISCOUNTED (IF < 1 PROJEC				(SI	R)=(5 / 1F)=	•	2.23		
	7.	SIMPLE PAYB	ACK	PERIOD (ES	STIMATED)	SPB=1F	<b>'</b> 4		5.24		

CONSTRUCTION COST ESTIMA	TE		DATE PR	EPARED	Mar-90		SHEET 1	OF
PROJECT				BASIS FOR E				
USDB ENERGY STUDY LOCATION FORT LEAVENWORTH, KS				x	CODE	NO DESIGN	RY DESIG	
ARCHITECT/ENGINEER CLARK RICHARDSON & BISKU	Р					(FINAL DES (SPECIFY)		
DRAWING NO.		ESTIM	ATOR	TGD	-	CHECKED BY	/ MAW	
	QUA	NTITY		IATERIAL		ABOR		OTAL
	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL		OST
6" DIA 2" THICK FIBERGLASS INSULATION	400	LF	\$5.87	\$2,348	\$3.45	\$1,380		\$3,7
ALUMINUM JACKET	400	LF	\$0.54	\$216	\$2.87	\$1,148		\$1,3
8" DIA. SCH. 80 STEEL PIPE	100	LF	\$37.66	\$3,766	\$22.00	\$2,200		\$5,9
8" DIA 2" THICK FIBERGLASS INSULATION	200	LF	\$7.25	\$1,450	\$4.31	\$862		\$2,3
ALUMINUM JACKET	200	LF	\$0.54	\$108	\$2.87	\$574		\$6
PIPE RACKS	6	EA	\$400	\$2,400	\$200	\$1,200		\$3,6
REPAIR HOLES IN PIPING	3	DAYS			\$252	\$756		\$7
8" DIA. TEE	2	EA	\$71	\$142	\$71	\$142		\$2
8" DIA. 90° ELBOW	2	EA	\$100	\$200	.\$140	\$280		. \$4
DEMOLITION	100	LF			\$3.95	\$395		\$3
A							-	
)								
SUBTOTAL				\$10,630		\$8,937		\$19,5
DIFFICULTY FACTOR 50%					50%	\$4,469		\$4,4
SUBTOTAL						\$13,406		\$24,0
CONTINGENCY 10%			10%	\$1,063	10%	\$1,341		\$2,4
SUBTOTAL				\$11,693		\$14,747		\$26,4
WORK COMP,TAX,SOC.SEC.,INS			3.50%	\$409	13.0%	\$1,917		\$2,3
DIRECT COST				\$12,102		\$16,664		\$28,7
OVERHEAD AND PROFIT			25%	\$3,026	25%	\$4,166		\$7,1
SUBTOTAL				\$15,128		\$20,830		\$35,9
CONSTRUCTION COST ENG. FORM 150								\$35,9

ENG. FORM 1AVC-59



## **ECO-M15**

BOILER PLANT MODIFICATIONS

	CALCULATION SHEET	DATE Mar-90	SHEET OF
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCU	LATION
LOCATION	FORT LEAVENWORTH, KANSAS	X HAND	
ARCHITECT/			CTOR BID  (SPECIFY)
ECO MEASU		COMPUTED BY BMS	CHECKED BY MAW

#### **BUILDING 474 - CENTRAL HEATING PLANT**

#### TEST DATA, BOILER #2

 % OXYGEN
 6.3 %

 STACK TEMPERATURE
 450 ° F

 % EXCESS AIR
 37. %

 COMBUSTION EFFICIENCY
 80.50%

 %CO 2
 8.3 %

STEAM PRODUCTION, ACCORDING TO BOILER PLANT OPERATORS:

SUMMER 75,000 LBS/DAY WINTER 370,000 LBS/DAY AVERAGE (CALCULATED) 148,750 LBS/DAY

BOILER TRIM CONTROL REDUCES EXCESS AIR TO 15%

FROM "GAS COMBUSTION EFFICIENCY CHART" PUBLISHED BY COOPERATIVE EXTENSION SERVICE, KANSAS STATE UNIVERSITY, MANHATTAN KS.:

15% EXCESS AIR AT 317°F = 84.50% COMBUSTION EFF.

84.50% - 80.50% = 4.00% INCREASE IN COMB. EFF.

ENTHALPY OF STEAM LEAVING BOILERS
ENTHALPY OF CONDENSATE RETURNING TO BOILERS
ENTHALPY DIFFERENCE

1192.4 BTU/LB
128 BTU/LB
1064.4 BTU/LB

148,750 LBS/DAY X 1,064 BTU/LB X 365 DAYS/YR > 0.000001 MBTU/BTU =

57,769 MBTU/YR.

THIS TRANSLATES TO GAS CONSUMPTIONS OF

57,769 / 80.50% = 71,763 MBTU/YR.

AND

57,769 / 84.50% = 68,366 MBTU/YR. WITH O2 TRIM CONTROLS.

SAVINGS

71,763 - 68,366 = 3,397 MBTU/YR.

4.08 X 3,397 = \$13,860 PER YEAR

PF FIS	ENERGY STALLATION & LO ROJECT NO. & TITE SCAL YEAR 1990	LE: 1496 DIS	ION INVEST	MENT PRO VORTH - TION NAM	OGRAM (EC USDB REG IE: ECOM1	ION NOS.	7	UDY: USDBAE LCCID 1.035 CENSUS: 2
ΑN	IALYSIS DATE: 0	13-28-90	ECONOMI	J LIFE 15	IEARO	FULLAN	LD 01.	0115
1.	INVESTMENT A. CONSTRUCTI B. SIOH C. DESIGN COS D. ENERGY CRE E. SALVAGE VAI F. TOTAL INVES	T EDIT CALC (1/ LUE COST		)			\$ \$ \$ \$ \$ <sub>-</sub> \$ \$	36865. 2212. 2028. 36995. 0. 36995.
2.	ENERGY SAVING ANALYSIS DATE	GS (+) / COST ( ANNUAL SAV	(-) INGS, UNIT	COST & D	ISCOUNTE	D SAVINGS		
	FUEL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(		NUAL \$ VINGS(3)	DISCOU! FACTOR		DISCOUNTED SAVINGS(5)
	A. ELECT \$ B. DIST \$ C. RESID \$ D. NAT G E. COAL \$	12.44 .00 .00 4.08 .00	0. 0. 0. 3397. 0.	\$ \$ \$ \$ \$	0. 0. 0. 13860. 0.	· 12.		0. 0. 0. 161746. 0.
	F. TOTAL		3397.	\$	13860.		\$	161746.
3.	NON ENERGY SA	AVINGS(+) / CO	OST(-)					
	A. ANNUAL REC		DIE A		0.11		\$	0.
	(1) DISCOUN (2) DISCOUN			3A1)	9.11		\$	0.
	C. TOTAL NON E	ENERGY DISC	OUNTED SA	VINGS(+)	/COST(-) (3	3A2+3Bd4)	\$	0.
	B IF 3D1 IS C IF 3D1B		' CALC (2F5 O TO ITEM 4 SIR = (2F5+ 'O ITEM 4	X .33)   	-Y	\$ 5337	′6. —	
4.	FIRST YEAR DOL	LLAR SAVINGS	6 2F3+3A+(3	B1D/(YEA	RS ECONO	MIC LIFE))	\$	13860.
5.	TOTAL NET DISC	COUNTED SAV	'INGS (2F5+	3C)			\$	161746.
6.	DISCOUNTED SA (IF < 1 PROJECT			(SI	R)=(5 / 1F)=	4.	37	
7.	SIMPLE PAYBAC	K PERIOD (ES	STIMATED)	SPB=1F/	4	2.	67	

CONSTRUCTION COST ESTIM	MATE		DATE PR	EPARED	SHEET OF		
PROJECT				BASIS FOR E	Mar-90 STIMATE		
USDB ENERGY STUDY OCATION FORT LEAVENWORTH, KS				x	CODE	(PRELIMINA	N COMPLETED) ARY DESIGN)
ARCHITECT/ENGINEER CLARK RICHARDSON & BISI	KUP					(FINAL DES (SPECIFY)	iGN)
DRAWING NO.	101	ESTIM	ATOR	2110		CHECKED B	Y MAW
NONE	QUA	ANTITY	М	BMS ATERIAL	L	ABOR	TOTAL
ECO-M15	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
					45.005	447.055	\$04.0FF
OXYGEN TRIM CONTROL	3	EA	\$2,100	\$6,300	\$5,985	\$17,955	\$24,255
• .					•		
SUBTOTAL				\$6,300		\$17,955	\$24,255
CONTINGENCY 10%			10%	\$630	10%	\$1,796	\$2,426
SUBTOTAL				\$6,930		\$19,751	\$26,681
WORK COMP, TAX, SOC. SEC., INS			3.50%		13.0%	\$2,568	\$2,811
DIRECT COST				\$7,173		\$22,319	\$29,492
OVERHEAD AND PROFIT	_		25%	\$1,793	25%	\$5,580	\$7,373
SUBTOTAL				\$8,966		\$27,899	\$36,865
CONSTRUCTION COST							\$36,865

ENG. FORM 150 1AVC-59

PF FIS		TION INVEST PRT LEAVENV SCRETE POR	MENT PE VORTH -	ROGRAM (E) USDB REG .ME: GROUF	9 #4	L	OY: USDBAE CCID 1.035 CENSUS: 2
A١	IALYSIS DATE: 12-5-90	ECONOMI	C LIFE 15	5 YEARS	PREPARED	BY: CF	RB
1.	INVESTMENT A. CONSTRUCTION COST B. SIOH C. DESIGN COST D. ENERGY CREDIT CALC ( E. SALVAGE VALUE COST F. TOTAL INVESTMENT (1D-		)			****	98342. 5901. 5409. 98687. 0. 98687.
2.	ENERGY SAVINGS (+) / COSTANALYSIS DATE ANNUAL SA	(-) VINGS, UNIT	COST & I	DISCOUNTE	D SAVINGS		
	FUEL UNIT COST \$/MBTU(1)			NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)		SCOUNTED VINGS(5)
	A. ELECT \$ 12.44 B. DIST \$ .00 C. RESID \$ .00 D. NAT G \$ 4.08 E. COAL \$ .00	0. · 0. 0. 7199. 0.	\$ \$ \$ \$ \$ \$	0. 0. 0. 29372. 0.	8.69 12.42 12.21 11.67 10.36		0. 0. 0. 342771. 0.
	F. TOTAL	7199.	\$	29372.		\$	342771.
3.	NON ENERGY SAVINGS(+) /	COST(-)					
	A. ANNUAL RECURRING (+/-			0.44		\$	0.
	<ul><li>(1) DISCOUNT FACTOR (*</li><li>(2) DISCOUNTED SAVING</li></ul>		3A1)	9.11		\$	0.
	C. TOTAL NON ENERGY DIS	COUNTED SA	VINGS(+	) /COST(-) (	3A2+3Bd4)	\$	0.
	D. PROJECT NON ENERGY (1) 25% MAX NON ENERGY (A IF 3D1 IS = OR > 3C B IF 3D1 IS < 3C CALC C IF 3D1B IS = > 1 GOD IF 3D1B IS < 1 PROJ	GY CALC (2F5 GO TO ITEM 4 SIR = (2F5+ TO ITEM 4	X .33) 4 -3D1)/1F)		\$ 113114. 		
4.	FIRST YEAR DOLLAR SAVING	GS 2F3+3A+(3	B1D/(YE	ARS ECONO	MIC LIFE))	\$	29372.
5.	TOTAL NET DISCOUNTED SA	VINGS (2F5+	3C)			\$	342771.
6.	DISCOUNTED SAVINGS RAT (IF < 1 PROJECT DOES NOT		(\$	SIR)=(5 / 1F)=	3.47		
7.	SIMPLE PAYBACK PERIOD (I	ESTIMATED)	SPB=1	F/4	3.36		

TELEPHONE approximately 7,199 million BTU's per year that could be SOURCE OF FUNDS The boiler plant in building 474 will continue to waste SUFFIX BUILDING/FACILITY SUFFIX BUILDING/FACILITY NUMBER PERSON TO CALL FOR ADDITIONAL INFORMATION NUMBER SUFFIX saved by implementing these measures. BUILDINGIFACIUTY DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED APOWer IPI Ant Moditifito ations いしためのみ SUPFIX FACILITIES ENGINEERING WORK REQUEST - XFA, XFB, XFC SUILDING/FACILITY SHORT JOB DESCRIPTION スのあるおり SUFFIX SUILDING/FACILITY NUMBER pressure from 120 psig to 80 psig for all steam loads at the USDB except the laundry, served by a separate 120 psig boiler. -Replace approximately 100 feet of 8" condensate piping. Insulate approximately 400 feet of 6" piping and 200 feet of 8" piping. -Inspect and service or replace steam traps. -Upon replacement of existing boilers, reduce steam distribution SUFFIX -Purchase oxygen trim controls for any new boilers. These energy conservation measures will show economic payback. BUILDINGFACILITY OTHER FUND CITATION スロスののと Make the following boiler plant modifications: SUFFIX BUILDING/FACILITY 9 1 0 1 3 1 NUMBER DATE Š NOTE AMEDIAN RETER TO PROPER Ϋ́ IPTION AND JUSTIFICATION OF WORK TO REACCOMPLISHED SUFFIX SUFFIX BUILDING/FACILITY SUILDING/FACILITY P 10 14 17 4 15 NUMBER いしないのだ IALE DOCUMENT NUMBER TYPE DOCUMENT NUMBER Y ٠٨: SERIAL . NUMBER SERIAL NUMBER: 1 1 D B B D 2 ° °

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The state of the s	SNAN E		WC WC		PACILITIES ENGINEER		ま!- ぐ0			FORWARDED TO	ROTAMITOR
	TELEPHONE NO. SIGNATURE	BOVAL	ESTIMATED COST WORK TO SE FROM	DENED REST		WO L S CEF-HELP	TOTAL 5 108,980 TROOP		ION		
	08GAN12AT10N	FORWARD FOR APPROVAL	ENVIRONMENTAL INPACT	N 0 %	© CNVIRCOMENTAL CONSIDERATIONS		C COMPLETED		APPROVAL ACTION	DATE	ACTION TAKEN
	(TO#0		RECOMMENDED	אטזדטע	C LPPROVAL	OISAPPROVAL	1			UMBER	
							יאט אטיאטאוזץ.			DOCUMENT NUMBER	

AUTOMATIC REIMB.

O OLRECT

AUTOMATIC ASIM

PUNDED ASIMB.

EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED. 4283

O - OISAPPROVED

A - APPROVED

5 6

r y TYPE

SERIAL

WHITE (ORIGINAL) – PROJECT FILE COPY PINK – FORWARD TO KEYPUNCH AFTER COMPLETION OF "APPROVAL ACTION" BLOCK YNZ GROUP 4 - PAGE 18

SIGNATURE OF APPROVAL AUTHORITY

М О

COMPLETION OF "FORWARD FC APPROVAL" SOON APPROVAL" ;

ところにし

## GROUP 5

#### ENERGY CONSERVATION ANALYSIS ESOS

PROJECT GROUP	ECC	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 5 Building 475 Repairs  475 Attic Insulation - Rotunda 475 Exhaust Heat Recovery 475C Air System Repair 475D Air System Repair 475F Air System Repair 475G Air System Repair 475A Lighting Levels - Chapel 475B Lighting Levels 475H Lighting Levels 475A Energy Efficient Lighting GROUP 5 TOTALS	ECO-A3 ECO-M5 ECO-M11 ECO-M11 ECO-M11 ECO-E1 ECO-E1 ECO-E1 ECO-E1	142 453 273 277 307 247 3 3 2 8	\$2,130 \$1,458 \$1,474 \$1,641 \$1,323 \$43 \$40 \$21 \$100	\$4,868 \$12,909 \$1,779 \$1,779 \$1,779 \$213 \$213 \$213 \$213 \$131 \$25,663	7.96 6.66 1.51 1.49 1.34 1.67 4.70 5.00 9.50 1.24 3.40	1.76 7.72 7.83 8.68 6.99 2.40 2.20 1.20 9.00
GROUP 5 FUNDING CATEGORY: F	PECIP					

## ECO-A3

ATTIC INSULATION

### ECO-A3 ECONOMIC ANALYSIS

	STEAM CONS	SUMPTION		ELECTRIC (		ON	TOTAL
BUILDING NUMBER	BASE ENERGY (THERMS)	ECO-A3 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	ECO-A3 LOAD (KW)	ENERGY SAVINGS (MBTU)	SAVINGS (\$)
	(TILTIMO)	(11.12.11.10)					
463	1,577	1,379	20	83,903	82,814	4	\$127
	2,195	1,311	88	91.802	86,441	18	\$588
464			27	234,490	232,543	· 7	\$194
472	15,515	15,241		58,399	58,386	0	\$578
475	13,619	12,203	142		611,617	0	\$169
475E	21,657	21,253	40	611,712	011,017	<u> </u>	\$1,657

	ENER	GY (	CONSERVAT	OST ANALYSIS S ION INVESTMEI	NT PF	ROGRAM (EC	IP)		JDY: USDBAE LCCID 1.035
PR	OJECT NO. & T	TITLE O	E: 1496 DIS	RT LEAVENWOR CRETE PORTIO ECONOMIC LI	N NA	ME: 475A3			CENSUS: 2
1.	INVESTMENT A. CONSTRUG B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	OST OST OREI VAL	DIT CALC (1/ UE COST					\$\$\$\$\$	4592. 276. 253. 4609. 0. 4609.
2.	ENERGY SAV ANALYSIS DA	ING:	S (+) / COST ANNUAL SAV	(-) INGS, UNIT CO	ST&	DISCOUNTE	SAVINGS		
	FUEL		UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 142. 0.	\$\$\$\$\$	0. 0. 0. 579.	11.16 17.19 17.12 16.15 13.92		0. 0. 0. 9351. 0.
	F. TOTAL			142.	\$	579.		\$	9351.
3.	NON ENERGY	/ SA	VINGS(+)/C	OST(-)					
	A. ANNUAL R	ECL	JRRING (+/-) FACTOR (TA	ARIFA)		11.65		\$	0.
	(2) DISCO	UNT	ED SAVING/	COST (3A X 3A	1)			\$	0.
	C. TOTAL NO	N E	NERGY DISC	OUNTED SAVIN	IGS(-	+) /COST(-) (3	3A2+3Bd4)	\$	. 0.
	(1) 25% M A IF 3D B IF 3D C IF 3I	AX N 01 IS 01 IS D1B	NON ENERGY = OR > 3C G < 3C CALC IS = > 1 GO	UALIFICATION TY CALC (2F5 X SO TO ITEM 4 SIR = (2F5+3D FO ITEM 4 SCT DOES NOT (	.33) 1)/1F	)=	\$ 3086.		
4.	FIRST YEAR I	DOL	LAR SAVING	S 2F3+3A+(3B11	D/(YE	ARS ECONO	MIC LIFE))	\$	579.
5.	TOTAL NET D	ISC	OUNTED SAY	VINGS (2F5+3C)				\$	9351.
6.	DISCOUNTED (IF < 1 PROJE	SA	VINGS RATIO	O QUALIFY)	(	SIR)=(5 / 1F)=	2.03		

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

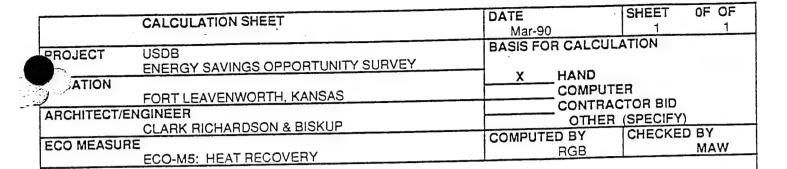
CONSTRUCTION COST ESTIMATE			DATE PRI		4/2/90		SHEET OF	5
PROJECT				BASIS FOR E	STIMATE			
USDB ENERGY STUDY OCATION				X	CODE A	(NO DESIGN	COMPLETED)	
FORT LEAVENWORTH, KS					CODE B	(PRELIMINAR) (FINAL DESIG	Y DESIGN) N)	
CLARK RICHARDSON & BISH	(UP				OTHER (	SPECIFY)		
DRAWING NO.		ESTIM.	ATOR	DLS		CHECKED BY	TOL	
NONE ECO-A3		YTITA		ATERIAL		ABOR TOTAL	TOTAL COST	
ATTIC INSULATION	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	0031	
BUILDING 475								
10" BATT INSULATION	3316	SQ FT	0.70	2,321	0.15	497	\$2	2,819
MOBILIZATION	3316	SQ FT			0.10	332	9	\$332
					•			
<u> </u>								
SUBTOTAL		ļ	ļ	\$2,321		\$829		3,15
CONTINGENCY 10%			10%	\$232	10%			\$31
SUBTOTAL				\$2,553		\$912		3,46
WORK COMP,TAX,SOC.SEC.,INS			3.50%	\$89	13.0%			\$20
DIRECT COST				\$2,642		\$1,031	\$3	3,67
OVERHEAD AND PROFIT		<u> </u>	25%	\$661	25%	\$258		\$91
SUBTOTAL		<del> </del>		\$3,303		\$1,289		4,59
CONSTRUCTION COST							\$	4,59

ENG. FORM 1AVC-59

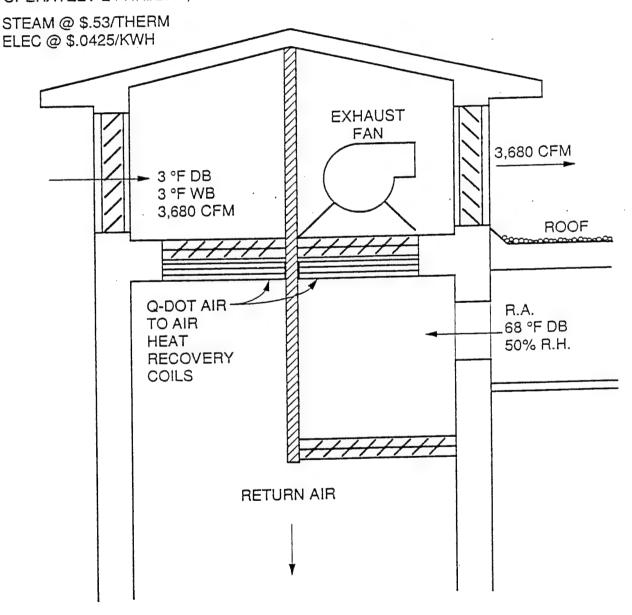


## ECO-M5

EXHAUST HEAT RECOVERY



OPERATED: 24 HR./DAY, NOVEMBER THROUGH MARCH



# Q-DOT HEAT RECOVERY SYSTEM TYPICAL SECTION BUILD

	•								
PR	ENER STALLATION & OJECT NO. & OCAL YEAR 199 ALYSIS DATE:	IGY C LOC TITLE	CONSERVAT ATION: FOF E: 1496 DIS	CRETE POR	MENT PR VORTH - ITION NAM	OGRAM (EC USDB REG ME: ECOM5	Q		DY: USDBAE LCCID 1.035 CENSUS: 2
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY C E. SALVAGE F. TOTAL INV	OST CREE VALU	DIT CALC (1) JE COST					\$ \$ \$ \$ \$ \$	12178. 731. 670. 12221. 0. 12221.
2.	ENERGY SAV ANALYSIS DA	INGS	S (+) / COST NNUAL SAV	(-) 'INGS, UNIT	COST & D	ISCOUNTE	D SAVINGS		
	FUEL		JNIT COST S/MBTU(1)	SAVINGS MBTU/YR(		NUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)		SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	-1. 0. 0. 453. 0.	\$ \$ \$ \$ \$	-12. 0. 0. 1848. 0.	8.69 12.42 12.21 11.67 10.36		-104. 0. 0. 21566. 0.
<b>,</b>	F. TOTAL			452.	\$	1836.		\$	21462.
3.	NON ENERG	Y SA'	VINGS(+)/C	OST(-)			•		
	A. ANNUAL F	RECU	IRRING (+/-) FACTOR (T	ARIFA)		9.11		. \$	0.
	(2) DISCC	TAUC	ED SAVING	COST (3A X	3A1)	<b></b>	•	\$	0.
•	C. TOTAL NO	ON EI	NERGY DISC	COUNTED SA	AVINGS(+)	/COST(-) (	3A2+3Bd4)	\$	0.
	A IF 31 B IF 31 C IF 3	IAX N D1 IS D1 IS D1B	ION ENERG = OR > 3C C < 3C CALC IS = > 1 GO	Y CALC (2F5 30 TO ITEM - SIR = (2F5-	X .33) 4 ⊦3D1)/1F)∍		\$ 7082.		
4.	FIRST YEAR	DOLI	LAR SAVING	S 2F3+3A+(3	BB1D/(YE/	ARS ECONO	MIC LIFE))	\$	1836.
5.	TOTAL NET	DISC	OUNTED SA	VINGS (2F5+	3C)			\$	21462.
6.	DISCOUNTEI (IF < 1 PROJI	D SA' ECT I	VINGS RATIO DOES NOT C	O QUALIFY)	(S	SIR)=(5 / 1F)=	= 1.76		
7.	SIMPLE PAY	BAC	( PERIOD (E	STIMATED)	SPB=1F	-/4	6.66		

CONSTRUCTION COST ESTIMA	ATE		DATE PRE	PARED	SHEET OF		
PROJECT				BASIS FOR ES	STIMATE		
USDB ENERGY STUDY LOCATION FORT LEAVENWORTH, KS ACHITECT/ENGINEER				x	CODE B	(NO DESIGN (PRELIMINA (FINAL DESI (SPECIFY)	I COMPLETED) RY DESIGN) IGN)
CLARK RICHARDSON & BISK	UP	ESTIM	ATOR I		OTHER	CHECKED BY	1
DRAWING NO. ECO-M5				RGB		ABOR	MAW TOTAL
Q-Dot Air to Air Heat Recovery System	NO. UNITS	UNIT MEAS.	PER	TOTAL	PER UNIT	TOTAL	cost
Q-Dot Air to Air Units	1	EA	\$3,467	\$3,467	\$2,000	\$2,000	\$5,467
MISC. CONTROLS	1	EA	\$400	\$400	\$100	\$100	\$500
SEALED SHEET METAL BLOCK OFF	63	SQ. FT	\$2	\$126	\$12	\$756	\$882
PROP. FAN W/ SHEET METAL HOUSING	1	EA	\$900	\$900	\$500	\$500	\$1,400
SUBTOTAL		ļ		\$4,893		\$3,356	
CONTINGENCY 10%		-	10%	\$489	10%	\$336	\$825
SUBTOTAL				\$5,382		\$3,692	\$9,074
WORK COMP, TAX, SOC. SEC., INS			3.50%	\$188	13.0%	\$480	\$668
DIRECT COST				\$5,570		\$4,172	\$9,742
OVERHEAD AND PROFIT			25%	\$1,393	25%	\$1,043	\$2,436
SUBTOTAL				\$6,963		\$5,215	\$12,178
CONSTRUCTION COST ENG. FORM 150							\$12,178

ENG. FORM 1AVC-59



## ECO-M11

CASTLE AIR SYSTEM REPAIR



## ECO-M11 ECONOMIC ANALYSIS

BUILDING NUMBER	STEAM CONS BASE ENERGY (THERMS)	ECO-M11 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	CONSUMPTION CONSUM	ON ENERGY SAVINGS (MBTU)	TOTAL SAVINGS (\$)
4750	13,472	10,745	273	45,478	45,427	0	\$1,115
475C	15,188	12,422	277	53,358	53,317	0	\$1,130
475D 475F	15,188	12,856	307	53,357	53,324	0	\$1,254
475G	12,853	10,380	247	45,481	45,427	0	\$1,011
4/30	12,000	10,000					\$4,510



INS	ENER STALLATION & OJECT NO. &	GY C	ONSERVAT ATION: FOF		MENT PR ORTH -	OGRAM (EC USDB REG	ION NOS. 7	STU	JDY: USDBAE LCCID 1.035 CENSUS: 2
FIS	CAL YEAR 19 ALYSIS DATE	90	DIS	CRETE POR	TION NAM CLIFE 15	ME: ECOM1 YEARS	1C PREPARED	BY: 0	CRB
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY ( E. SALVAGE F. TOTAL INV	OST CRED VALU	OIT CALC (1/ JE COST					\$ \$ \$ \$ \$ \$ \$	1678. 101. 92. 1684. 0. 1684.
2.	ENERGY SAV	/INGS	S (+) / COST NNUAL SAV	(-) 'INGS, UNIT (	COST & D	ISCOUNTE	D SAVINGS		
	FUEL		JNIT COST J/MBTU(1)	SAVINGS MBTU/YR(2		NUAL \$ NVINGS(3)	DISCOUNT FACTOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAŢG E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 273. 0.	\$ \$ \$ \$ \$ \$	0. 0. 0. 1114. 0.	8.69 12.42 12.21 11.67 10.36		0. 0. 0. 13000. 0.
	F. TOTAL			273.	\$	1114.		\$	13000.
3.	NON ENERG	Y SAV	/INGS(+) / C	OST(-)			•		
	A. ANNUAL I	RECU	RRING (+/-) FACTOR (T.	ABLE A)		9.11		\$	0.
	(2) DISCO	TNUC	ED SAVING/	COST (3A X	3A1)			\$	0.
	C. TOTAL NO	NE NC	NERGY DISC	OUNTED SA	VINGS(+)	/COST(-) (	3A2+3Bd4)	\$	0.
	A IF 31 B IF 31 C IF 3	MAX N D1 IS D1 IS BD1B	ION ENERG = OR > 3C C < 3C CALC IS = > 1 GO	Y CALC (2F5 30 TO ITEM 4 SIR = (2F5+	X .33) <b>;</b> ·3D1)/1F):		\$ 4290.		
4.	FIRST YEAR	DOL	AR SAVING	S 2F3+3A+(3	B1D/(YE/	ARS ECONO	MIC LIFE))	\$	1114.
5.	TOTAL NET	DISCO	OUNTED SA	VINGS (2F5+	3C)			\$	13000.
6.	DISCOUNTE (IF < 1 PROJ	D SA\ ECT [	VINGS RATIO	O QUALIFY)	(S	SIR)=(5 / 1F):	= 7.72		
7.	SIMPLE PAY	BACK	( PERIOD (E	STIMATED)	SPB=1F	-/4	1.51		

LIFE CYCLE COST ANALYSIS SUMMARY  ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)  INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7  PROJECT NO. & TITLE: 1496 FISCAL YEAR 1990  DISCRETE PORTION NAME: ECOM11D										
	ALYSIS DATE:			ECONOMIC LI	FE 15	YEARS	PREPA	RED I	BY: 0	CRB
1.	INVESTMENT A. CONSTRUCT B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	CTION OST CREDI VALU	IT CALC (1/ E COST						\$\$\$\$\$\$\$	1678. 101. 92. 1684. 0. 1684.
2.	ENERGY SAV ANALYSIS DA	INGS TE AI	(+) / COST NNUAL SAV	(-) 'INGS, UNIT COS	ST & [	DISCOUNTE	D SAVING	s		
	FUEL		NIT COST MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOU			DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 277. 0.	\$ \$ \$ \$ \$	0. 0. 0. 1130. 0.	12 12 11	3.69 2.42 2.21 1.67 0.36		0. 0. 0. 13187. 0.
	F. TOTAL			277.	\$	1130.			\$	13187.
3.	NON ENERGY	/ SAV	INGS(+) / C	OST(-)						
	A. ANNUAL R (1) DISCO (2) DISCO	UNT I	FACTOR (T	ABLE A) COST (3A X 3A	.1)	9.11			\$ \$	0. 0.
	' '			OUNTED SAVIN		) /COST(-) (	3A2+3Bd4)	)	\$	0.
	(1) 25% M A IF 3D B IF 3D C IF 3I	AX NO 01 IS = 01 IS < 01B IS	ON ENERG' = OR > 3C G < 3C CALC S = > 1 GO ]	UALIFICATION T Y CALC (2F5 X TO TO ITEM 4 SIR = (2F5+3D TO ITEM 4 CT DOES NOT (	.33) 1)/1F)		\$ 45	352.		
4.	FIRST YEAR (	DOLL	AR SAVING	S 2F3+3A+(3B1[	)/(YE	ARS ECONO	MIC LIFE)	)	\$	1130.
5.	TOTAL NET D	ISCO	UNTED SA	VINGS (2F5+3C)					\$	13187.
6.	DISCOUNTED (IF < 1 PROJE	SAV CT D	INGS RATIO	O QUALIFY)	(8	SIR)=(5 / 1F)=	=	7.83		

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4



PR( FIS	ENERG TALLATION & T DJECT NO. & T CAL YEAR 199 ALYSIS DATE:	GY COLOCATILE	ONSERVAT ATION: FOR : 1496 DIS	OST ANALYSIS S ION INVESTMEI IT LEAVENWOR CRETE PORTIO ECONOMIC LI	TH -	ROGRAM (EC USDB REG	10N NO			JDY: USDBAE LCCID 1.035 CENSUS: 2
1.	INVESTMENT A. CONSTRUC B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	OST RED VALU	IT CALC (1/						\$ \$ \$ \$ \$ \$ •	1678. 101. 92. 1684. 0. 1684.
2.	ENERGY SAV ANALYSIS DA	INGS TE A	(+) / COST NNUAL SAV	(-) INGS, UNIT CO	ST &	DISCOUNTE	D SAVIN	GS		
	FUEL	_	INIT COST /MBTU(1)	SAVINGS MBTU/YR(2)		ANNUAL \$ SAVINGS(3)		OUNT OR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	0. 0. 0. 307. 0.	\$ \$ \$ \$ \$	0. 0. 0. 1253. 0.		8.69 12.42 12.21 11.67 10.36		0. 0. 0. 14623. 0.
	F. TOTAL			307.	\$	1253.			\$	14623.
3.	NON ENERGY	/ SAV	/INGS(+) / C	OST(-)						
	A. ANNUAL P	ECU	RRING (+/-)	ADI 5 A)		9.11			\$	0.
	(1) DISCO (2) DISCO	UNT	FACTOR (Ť. ED SAVING/	ABLE A) COST (3A X 3A	11)	5.11			\$	0.
	C. TOTAL NO	N EN	IERGY DISC	COUNTED SAVI	NGS(	+) /COST(-) (	3A2+3Bc	i4)	\$	0.
	(1) 25% M A IF 3D B IF 3D C IF 3	AX N 01 IS 01 IS 01B I	ON ENERG' = OR > 3C G < 3C CALC S = > 1 GO	UALIFICATION Y CALC (2F5 X 30 TO ITEM 4 SIR = (2F5+3D TO ITEM 4 ECT DOES NOT	.33) 1)/1F	·)=	\$	4826.		
4.	FIRST YEAR	DOLL	AR SAVING	S 2F3+3A+(3B1	D/(YE	EARS ECONO	MIC LIF	E))	\$	1253.
5.	TOTAL NET	ISCC	OUNTED SA'	VINGS (2F5+3C)	1				\$	14623.
6.	DISCOUNTED	SAV ECT E	INGS RATIO	O QUALIFY)	(	(SIR)=(5 / 1F)=	=	8.68		

SPB=1F/4

7. SIMPLE PAYBACK PERIOD (ESTIMATED)

INS	ENER STALLATION & OJECT NO. &	GY CO	ONSERVATION: FOR	ST ANALYSIS ION INVESTME IT LEAVENWOI	NT PR	OGRAM (E	CIP) SION NO	)S. 7		Y: USDBAE CCID 1.035 CENSUS: 2
FIS	SCAL YEAR 199 ALYSIS DATE:	90	DISC	CRETE PORTIC ECONOMIC L	ON NAN IFE 15	ME: ECOM1 YEARS	I1G PRE	PARED	BY: CR	В
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY C E. SALVAGE F. TOTAL INV	CTION OST CREDI VALUI	T CALC (1 <i>A</i> E COST						* * * * * *	1678. 101. 92. 1684. 0. 1684.
2.	ENERGY SAV ANALYSIS DA	INGS TE AN	(+) / COST ( INUAL SAV	(-) INGS, UNIT CO	ST & D	ISCOUNTE	D SAVI	NGS		
	FUEL		NIT COST MBTU(1)	SAVINGS MBTU/YR(2)		INUAL \$ .VINGS(3)		OUNT TOR(4)		SCOUNTED VINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	12.44 .00 .00 4.08	0. 0. 0. 247. 0.	\$ \$ \$ \$ \$ \$	0. 0. 0. 1008. 0.		8.69 12.42 12.21 11.67 10.36		0. 0. 0. 11763. 0.
	F. TOTAL			247.	\$	1008.			\$	11763.
3.	NON ENERGY	Y SAV	INGS(+) / C	OST(-)						
	A. ANNUAL F (1) DISCO (2) DISCO	UNT F	FACTOR (TA	ABLE A) COST (3A X 3.	A1)	9.11			\$ \$	0. 0.
	C. TOTAL NO	N EN	ERGY DISC	OUNTED SAVI	NGS(+)	/COST(-) (	3A2+3B	d4)	\$	0.
	(1) 25% M A IF 30 B IF 30 C IF 3	AX NO 01 IS = 01 IS < D1B IS	ON ENERGY OR > 3C G 3C CALC S = > 1 GO T	UALIFICATION CALC (2F5 X O TO ITEM 4 SIR = (2F5+3E TO ITEM 4 CT DOES NOT	.33) )1)/1F)=		\$	3882.		

(SIR)=(5/1F)=

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE))

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

(IF < 1 PROJECT DOES NOT QUALIFY)

6. DISCOUNTED SAVINGS RATIO



6.99

1.67

1008.

CONSTRUCTION COST ESTIN	ATE		DATE PR	EPARED			SHEET OF
PROJECT USDB ENERGY STUDY			1	BASIS FOR E		// DECIDE	LOCUEL ETERY
LOCATION FORT LEAVENWORTH, KS				<u>x</u> _	CODE B	(NO DESIGN (PRELIMINA (FINAL DES	N COMPLETED) IRY DESIGN)
ACHITECT/ENGINEER CLARK RICHARDSON & BISH	KUP				OTHER	(SPECIFY)	
DRAWING NO.		ESTIM	ATOR	RGB		CHECKED B	MAW
NONE	QUA	NTITY		ATERIAL		ABOR	TOTAL
ECO-M11	NO. UNITS	UNIT MEAS.		TOTAL	PER UNIT	TOTAL	COST
METAL DOORS	2	EA	\$137	\$274	\$80	\$160	\$434
SHEET METAL ≈	50	SQ FT	\$1	\$63	\$1	\$70	\$133
CAULKING MASONRY =	400	LF	\$1	\$224	\$1	\$336	\$560
						•	
			<u> </u>				
		<u> </u>					
SUBTOTAL		-		\$560		\$566	
CONTINGENCY 10%			10%		10%		
SUBTOTAL		-		\$616	4	\$623	
WORK COMP,TAX,SOC.SEC.,INS		-	3.50%		13.0%		
DIRECT COST		-		\$638		\$704	
OVERHEAD AND PROFIT		-	25%		25%		
SUBTOTAL		-		\$798		\$880	
ENG. FORM 150 1AVC-59		1	<u></u>	<u></u>	L	<u> </u>	\$1,67





# ECO-E1

LIGHTING LEVELS



	CALCULATION SHEET	DATE Mar-90	SHEET OF
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULA	TION
OCATION	FORT LEAVENWORTH, KS	X HAND COMPUT	
ARCHITECT/		CONTRAC	CTOR BID (SPECIFY)
ECO MEASUR		COMPUTED BY DJG	CHECKED BY MAW

BASED ON THE FOLLOWING INFORMATION:

\$200.62 FOR TYPICAL MOTION SENSOR INSTALLATION

\$0.0425 PER KWH ELECTRICITY COST 11.16 25-YEAR DISCOUNT FACTOR

BUILDING # AND ROOM TYPE	LIGHTING WATTS	ANNUAL NORMAL HOURS	ANNUAL HOURS SAVED	ANNUAL KWH SAVED	ANNUAL SAVINGS	PAYBACK IN YEARS	SIR
450 CONFERENCE ROOM	1280	2080	624	799	\$33.96	5.9	1.9
475A CONFERENCE ROOM	640	2080	624	399	\$16.96	11.8	0.9
475A CHAPEL	1620	2080	624	1011	\$42.97	4.7	2.4
475E CONFERENCE ROOM	480	2080	624	300	\$12.75	15.7	0.7
475B CHAPEL	1500	2080	624	936	\$39.78	5.0	2.2
475H SHAPEL	800	2080	624	499	\$21.21	9.5	1.2
OTAL (SIR >1)	5200	2080	624	3245	\$137.91	8.7	1.3

	CALCULATION SHEET	DATE	SHEET OF
	-	Oct-90	<u> </u>
PROJECT	USDB	BASIS FOR CALCUI	_ATION
	ENERGY SAVINGS OPPORTUNITY SURVEY		
ATION		X HAND	
1.27	FORT LEAVENWORTH, KS	COMPUT	
ARCHITECT/E			CTOR BID
	CLARK RICHARDSON & BISKUP		(SPECIFY)
ECO MEASUR		COMPUTED BY	CHECKED BY
	ECO.E1	DJG	MAW

AVERAGE PAYBACK TIME FOR REPLACING EXISTING SWITCHES WITH INFRARED MOTION SENSORS FOR VARIOUS SPACES

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

MOTION SENSOR INSTALLATION COST DEMO EXISTING SWITCH BOX **DEMO 8' EMT WITH WIRING** INSTALL 20', 3/4" EMT

\$2.66 \$5.76 \$53.60 \$13.60 \$125.00

INSTALL 40', #12 CONDUCTORS INSTALL MOTION SENSOR TOTAL COST PER INSTALLATION

\$200.62

POSSIBLE ENERGY SAVINGS FOR TYPICAL CONFERENCE ROOM

720 WATTS · LIGHTING LOAD **2080 HOURS** ANNUAL LIGHTING TIME \$63,65 ANNUAL COST @ \$0.0425 PER KWH ANNUAL SAVINGS IF LIGHTS ARE OFF 30% OF TIME \$19.10 \$200.62 COST OF INSTALLATION **10.5 YEARS** PAYBACK TIME

POSSIBLE ENERGY SAVINGS FOR TYPICAL SMALL OFFICE ROOM

**320 WATTS** LIGHTING LOAD **2080 HOURS** ANNUAL LIGHTING TIME \$28.29 ANNUAL COST @ \$0.0425 PER KWH ANNUAL SAVINGS IF LIGHTS ARE OFF 25% OF TIME \$7.07 \$200.62 COST OF INSTALLATION **28.4 YEARS** PAYBACK TIME

NOTE: SAVINGS ARE VERY DEPENDENT ON SEVERAL ITEMS, WHICH INCLUDE THE FOLLOWING:

1) CURRENT PRACTICES IN SWITCHING LIGHTS OFF. IF PEOPLE NORMALLY TURN LIGHTS OFF WHEN NOT IN USE, ENERGY SAVINGS WILL BE MINIMAL.

2) AMOUNT OF TIME THAT LIGHTS WILL NOT BE IN USE. THE ABOVE ESTIMATES MAY VARY AND ACTUAL SAVINGS WILL FLUCTUATE ACCORDINGLY.

STUDY: USDBAE LIFE CYCLE COST ANALYSIS SUMMARY LCCID 1.035 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 1496 DISCRETE PORTION NAME: ECOE1 FISCAL YEAR 1990 PREPARED BY: CRB **ECONOMIC LIFE 25 YEARS** ANALYSIS DATE: 03-30-90 1. INVESTMENT 802. A. CONSTRUCTION COST 48. B. SIOH 44 C. DESIGN COST 805. D. ENERGY CREDIT CALC (1A+1B+1C)X.9 0. E. SALVAGE VALUE COST 805. F. TOTAL INVESTMENT (1D-1E) 2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS DISCOUNTED DISCOUNT ANNUAL \$ SAVINGS UNIT COST SAVINGS(5) FACTOR(4) SAVINGS(3) **FUEL** \$/MBTU(1) MBTU/YR(2) 1529. 11.16 137. A. ELECT 12.44 11. 0. 17.19 0. \$ .00 ٥. B. DIST \$ 0. 17.12 0. 0. \$ C. RESID \$ .00 .0. 16.15 0. \$ D. NAT G \$ 4.08 0. 13.92 0. \$ 0. E. COAL .00 1529. 137. 11. F. TOTAL 3. NON ENERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) 11.65 (1) DISCOUNT FACTOR (TABLE A) 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4) D. PROJECT NON ENERGY QUALIFICATION TEST 505. (1) 25% MAX NON ENERGY CALC (2F5 X .33) A IF 3D1 IS = OR > 3C GO TO ITEM 4 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= C IF 3D1B IS = > 1 GO TO ITEM 4 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY 137. 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) 1529. 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) 1.90 (SIR)=(5/1F)=

SPB=1F/4



6. DISCOUNTED SAVINGS RATIO

(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED)

5.88



# ECO-E2

## ENERGY EFFICIENT LIGHTING SYSTEMS





	CALCULATION SHEET	DATE SHEET OF 1 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATION
LOCATION	FORT LEAVENWORTH, KS	X HAND COMPUTER
ARCHITECT	/ENGINEER CLARK RICHARDSON & BISKUP	OTHER (SPECIFY)
ECO MEASU		COMPUTED BY CHECKED BY DJG MAW

#### AVERAGE PAYBACK TIME FOR RELAMPING AND REBALLASTING FLUORESCENT LIGHT FIXTURES

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

ASSUME FIXTURES ARE ON FOR 365 DAYS x 12 HOURS PER DAY = 4380 HOURS PER YEAR

#### 2 LAMP FLUORESCENT LIGHT FIXTURE

COST TO REBALLAST LIGHT FIXTURE \$58.00 COST TO RELAMP LIGHT FIXTURE WITH 34W LAMPS \$9.25 x 2 = TOTAL COST PER FIXTURE \$76.50

**ELECTRICITY SAVINGS** 

8W PER LAMP x 2 LAMPS PER FIXTURE = 16W PER FIXTURE PER HOUR = 0.016 KWH PER FIXTURE

\$0.0425 PER KWH x 0.016 KWH x 4380 HRS = \$2.98 PER YEAR

SIMPLE PAYBACK

TOTAL COST PER FIXTURE \$76.50
ELECTRICITY SAVINGS PER YEAR \$2.98
SIMPLE PAYBACK IN YEARS 25.7

#### 4 LAMP FLUORESCENT LIGHT FIXTURE

COST TO REBALLAST LIGHT FIXTURE \$58.00 x 2 = \$116.00 COST TO RELAMP LIGHT FIXTURE WITH 34W LAMPS \$9.25 x 4 = \$37.00 \$153.00

**ELECTRICITY SAVINGS** 

8W PER LAMP x 4 LAMPS PER FIXTURE = 32W PER FIXTURE PER HOUR = 0.032 KWH PER FIXTURE

\$0.0425 PER KWH x 0.032 KWH x 4380 HRS = \$5.97 PER YEAR

SIMPLE PAYBACK

TOTAL COST PER FIXTURE \$153.00 ELECTRICITY SAVINGS PER YEAR \$5.97 SIMPLE PAYBACK IN YEARS 25.6

	CALCULATION SHEET	DATE Mar-90	SHEET OF 1 1
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCULATI	ON
OCATION	FORT LEAVENWORTH, KS	X HAND COMPUT	
ARCHITECT/		OTHER	CTOR BID (SPECIFY)
ECO MEASU		COMPUTED BY DJG	CHECKED BY MAW

CALCULATIONS FOR RETROFITTING INCANDESCENT FIXTURES TO FLUORESCENT FIXTURES **BUILDING 475A STAIRWELL** 

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA

ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

ASSUME FIXTURES ARE ON FOR 365 DAYS x 24 HOURS PER DAY = 8760 HOURS PER YEAR

DESCRIPTION	NUMBER (EACH)	INSTALLED COST	TOTAL COST	ENERGY USE (W)	TOTAL ENERGY USE
ADAPTER BALLAST	6	\$11.00	\$66	3	. 18
13W DOUBLE TWIN TUBE FLUORESCENT LAMP	6	\$5.84	\$35	13	78
LABOR	6	\$3.75	\$23	0	0
TOTAL			\$124		0.096KW

EXISTING ELECTRICITY USAGE = 6 LAMPS x 60W PER LAMP = 360 W OR .36KW/H NEW ELECTRICITY USAGE = 0.096 KW/H

TOTAL ELECTRICTY SAVED = 0.36 KW/H - 0.096 KW/H = 0.264 KW/H

YEARLY SAVINGS = 0.264 KW/H x \$0.0425 /KWH x 8760 HOURS/YEAR = \$98.29 PER YEAR

PR FIS	ENER STALLATION & OJECT NO. & SCAL YEAR 199 JALYSIS DATE:	GY CALLOCATITLE	ONSERVAT ATION: FOF : 1496 DIS	CRETE POR	MENT PE ORTH <i>-</i> TION NA	ROGRAM (EC USDB REG ME: ECOE2	NOS. 7		UDY: USDBAE LCCID 1.035 CENSUS: 2 CRB
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY C E. SALVAGE F. TOTAL INV	OST CREDI VALU	IT CALC (1/			٠.		***	124. 7. 7. 124. 0. 124.
2.	ENERGY SAV ANALYSIS DA	INGS	(+) / COST NNUAL SAV	(-) 'INGS, UNIT (	COST & I	DISCOUNTE	D SAVINGS		
	FUEL		NIT COST MBTU(1)			NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ • \$	12.44 .00 .00 4.08 .00	8. 0. 0. 0.		100. 0. 0. 0. 0.	11.16 17.19 17.12 16.15 13.92		1116. 0. 0. 0.
ł.	F. TOTAL			8.	\$	100.		\$	1116.
3.	NON ENERGY	/ SAV	INGS(+) / C	OST(-)					
	A. ANNUAL R (1) DISCO (2) DISCO	<b>UNT</b> F	FACTOR (TA	ABLE A) COST (3A X	3A1)	11.65		\$ \$	<ul><li>0.</li><li>0.</li></ul>
	C. TOTAL NO	N EN	ERGY DISC	OUNTED SA'	VINGS(+	)/COST(-) (3	3A2+3Bd4)	\$	0.
	A IF 3D B IF 3D C IF 3I	AX NO 01 IS = 01 IS < 01B IS	ON ENERGY = OR > 3C G < 3C CALC S = > 1 GO T	CALC (2F5 O TO ITEM 4 SIR = (2F5+	X .33) 3D1)/1F)		\$ 368.		
4.	FIRST YEAR I	DOLL	AR SAVING	S 2F3+3A+(3E	31D/(YE/	ARS ECONO	MIC LIFE))	\$	100.
5.	TOTAL NET D	ISCO	UNTED SAV	/INGS (2F5+3	(C)			\$	1116.
6.	DISCOUNTED (IF < 1 PROJE				(S	SIR)=(5 / 1F)=	9.00		
_					000 46		4.04		

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4

1.24

	ENEF STALLATION & OJECT NO. &	RGY C	ONSERVAT	OST ANALYSI ION INVESTM RT LEAVENW	MENT PF	ROGRAM (E	CIP) GION NOS	i. 7		OY: USDBAE CCID 1.035 CENSUS: 2
FIS	CAL YEAR 19 ALYSIS DATE	90	DIS	CRETE PORT	TION NA CLIFE 15	ME: GROU YEARS	P #5 PREP	ARED	BY: CF	RB
1.	INVESTMENT A. CONSTRU B. SIOH C. DESIGN C D. ENERGY C E. SALVAGE F. TOTAL INV	OST CRED VALL	IT CALC (1/						\$ \$ \$ \$ \$ \$	24206. 1452. 1331. 24290. 0. 24290.
2.	ENERGY SAV ANALYSIS DA	INGS	(+) / COST NNUAL SAV	(-) 'INGS, UNIT (	COST & I	DISCOUNT	ED SAVINO	SS		
	FUEL		NIT COST /MBTU(1)	SAVINGS MBTU/YR(2		NNUAL \$ AVINGS(3)	DISCO FACTO			SCOUNTED AVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	17. 0. 0. 1699. 0.	\$ \$ \$ \$ \$ \$	211. 0. 0. 6932. 0.	. 1	8.69 2.42 2.21 1.67 0.36		1834. 0. 0. 80896. 0.
	F. TOTAL			1716.	\$	7143.			\$	82730.
3.	NON ENERG	Y SAV	'INGS(+) / C	OST(-)						
	A. ANNUAL F		RRING (+/-) FACTOR (T	ABLE A)		9.11			\$	0.
	(2) DISCO	UNT	ED SAVING/	COST (3A X	3A1)				\$	0.
	C. TOTAL NO	ON EN	ERGY DISC	OUNTED SA	VINGS(+	-) /COST(-)	(3A2+3Bd4	1)	\$	0.
	A IF 3I B IF 3I C IF 3	MAX N D1 IS D1 IS D1B I	ON ENERG' = OR > 3C G < 3C CALC S = > 1 GO	Y CALC (2F5 GO TO ITEM 4 SIR = (2F5+	X .33) 3D1)/1F)	) <b>=</b>	\$ 27	7301.		
4.	FIRST YEAR	DOLL	AR SAVING	S 2F3+3A+(3	B1D/(YE	ARS ECON	OMIC LIFE	E))	\$	7143.
5.	TOTAL NET I	OISCO	OUNTED SA	VINGS (2F5+	3C)				\$	82730.
6.	DISCOUNTE (IF < 1 PROJ				(	SIR)=(5 / 1F	·)=	3.41		
7.	SIMPLE PAY	BACK	PERIOD (E	STIMATED)	SPB=1	F/4		3.40		

BLA FORWARD TO KEYPUNCH AFTE COMPLETION OF "FORWARD FC APPROVAL" SLOCK TELEPHONE N BLANK ☐ DIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB. 75/7877/78 install motion sensors will result in continued waste of SOURCE OF FUNDS Heat Exhaust air will continue to waste heat to the outdoors, some of which could be used for preheat of ventilation けつ Failure to SUFFIX BUILDING/FACILITY lighting energy. Lighting energy will also continue be wasted if energy efficient fixtures are not used Energy will continue to be wasted in building 475. Air will continue to stratify in the Castle, BUILDING/FACILITY will be wasted through the underinsulated attic. NUMBER P 0 14 1.7 151A PERSON TO CALL FOR ADDITIONAL INFORMATION resulting in discomfort and wasted energy. NUMBER DATE SUFFIX GREEN BUILDING/FACILITY DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED P,0141751A WHITE IORIGINAL) – PROJECT FILE COPY
PINK – FORWARD TO REPPUNCH AFTER COMPLETION
OF "APPROVAL ACTION" BLOCK APPROVED FOR DESIGN ORGANIZATION NUMBER ABIULLICITUSE 14,715; RIELPRITS! I SIGNATURE SUFFIX **BUILDING/FACILITY** SHORT JOB DESCRIPTION 1 P 10 14 17 15 19 NUMBER REMARKS SUFFIX BUILDING/FACILITY air. DESIGN ESTIMATOR 19 20 21 2223 24 25 26 Q FACILITIES ENGINEER FORWARDED TO P 10 1417 15 F DA MO NUMBER DATE -Replace fan room doors and seal pipe penetrations in fan room walls in buildings 475C, 475D, 475F, and 475G.
-Install motion sensors for lighting control in buildings 475A, 475B, N O FROM SUFFIX 40 SIGNATURE OF APPROVAL AUTHORITY BUILDING/FACILITY O SELF-HELP -Add 10" of batt insulation to the attic of the rotunda. -Install a heat recovery unit to transfer heat from exhaust air WORK TO BE O IN-HOUSE CONTRACT GROUP 5 - PAGE 21 OTHER FUND CITATION 1 | P 10 14 17 15 1P TROOP -Replace existing light fixtures with high efficiency units TELEPHONE NO. SIGNATURE NUMBER ke the following modifications to the Castle buildings: , 25,663 UNFUNDED \$ 1,166 ESTIMATED COST SUFFIX BUILDING/FACILITY FUNDED TOTAL For use of this form. FORWARD FOR APPROVAL X X WO L ď P 10 1417 1512 1 1 1911 1011 13:1 NO. P 0 14 17 15 15 NUMBER EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED. APPROVAL ACTION 8 REQUESTER INFORMATION ENVIRONMENTAL 5 16 17 18 CONSIDERATIONS ď ENVIRONMENTAL IMPACT Ϋ́В DATE COMPLETED INITIATED Š SCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED SUFFIX C EIS/EIA C EIS/EIA SUFFIX BUILDING/FACILITY BUILDING/FACILITY O - OISAPPROVED ACTION TAKEN P10147518 ORGANIZATION A - APPROVED 9 Ø Ø **E**3) NUMBER NUMBER DISAPPROVAL RECOMMENDED ACTION APPROVAL TYPE TYPE ventilation air. DOCUMENT NUMBER Υ٩ DOCUMENT NUMBER ٠٨, TYPE DOCUMENT NUMBER ŁΑ UO SERIAL . SERIAL NUMBER NUMBER 8 9 10 11 SERIAL NUMBER 7 8 9 and 475H. ROVING AUTHORITY 6 7 4283 REG aga Io 9 õ 03/ FORM AUG 78 DNAH เก CHANGE 2 3 4 RANS 2 3 ANS U <u>۷</u> m

FACILITIES ENGINEERING WORK REQUEST - XFA, XFB, XFC , see AR 420-17 and DA Pam 420-6; the proponent agency is the Office of the Chief of Engineers.

see AR 420-17 and DA Pam 420

# GROUP 6

### ENERGY CONSERVATION ANALYSIS ESOS

PROJECT GROUP	EΩ	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 6 Building 450 Repairs						
Solar Window Shading	ECO-A6 ECO-E1	3 6 3	\$256 \$34	\$2,121 \$213	7.84 5.90	1.6 1.9
GROUP 6 TOTALS			\$290	\$2,334	7.58	1.2
	GROUP 6 Building 450 Repairs Solar Window Shading ighting Levels GROUP 6 TOTALS	GROUP 6 Building 450 Repairs  Solar Window Shading ECO-A6 ighting Levels ECO-E1	GROUP 6 Building 450 Repairs  Solar Window Shading ECO-A6 36 ighting Levels ECO-E1 3	GROUP 6 Building 450 Repairs  Solar Window Shading ECO-A6 36 \$256 ighting Levels ECO-E1 3 \$34 \$34 \$360UP 6 TOTALS	GROUP 6 Building 450 Repairs  Solar Window Shading ECO-A6 36 \$256 \$2,121 ighting Levels ECO-E1 3 \$34 \$213 \$36 \$200 \$2,334	GROUP 6         Building 450 Repairs           Golar Window Shading ighting Levels         ECO-A6         36         \$256         \$2,121         7.84           GROUP 6 TOTALS         39         \$290         \$2,334         7.58



# ECO-A6

SOLAR WINDOW SHADING





## **ECO-A6 ECONOMIC ANALYSIS**

	STEAM CONS	SUMPTION		ELECTRIC (		ON	TOTAL
BUILDING NUMBER	BASE ENERGY (THERMS)	ECO-A6 LOAD (THERMS)	ENERGY SAVINGS (MBTU)	BASE LOAD (KW)	ECO-A6 LOAD (KW)	ENERGY SAVINGS (MBTU)	TOTAL SAVINGS _(\$)
					100.007		\$407
450	3,629	2,920	71	135,466	132,697	9	
463	1.577	1,796	-22	83,903	82,425	5	(\$27)
464	2,195	2,352	-16	91.802	90,467	5	(\$7)
472	15,515	15,515	0	234,490	229,344	18	\$218
		2,609	-20	148,420	145,653	9	\$35
473	2,407		0	146,357	136,920	32	\$401
475A	12,773	12,773			93,496	6	\$73
475B	8,477	8,477	0	95,207		5	\$59
475H	8,137	8,137	0	87,858	86,474	5	
							\$751





STUDY: USDBAE LIFE CYCLE COST ANALYSIS SUMMARY LCCID 1.035 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7 CENSUS: 2 PROJECT NO. & TITLE: 1496 **DISCRETE PORTION NAME: 450A6** FISCAL YEAR 1990 PREPARED BY: CRB **ECONOMIC LIFE 25 YEARS** ANALYSIS DATE: 03-30-90 INVESTMENT 2001. A. CONSTRUCTION COST \$ 120. B. SIOH \$ 110. C. DESIGN COST 2008. \$ D. ENERGY CREDIT CALC (1A+1B+1C)X.9 0. -\$ E. SALVAGE VALUE COST 2008. F. TOTAL INVESTMENT (1D-1E) 2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS DISCOUNTED DISCOUNT UNIT COST **SAVINGS** ANNUAL \$ SAVINGS(5) FACTOR(4) SAVINGS(3) FUEL \$/MBTU(1) MBTU/YR(2) 1808. 11.16 162. A. ELECT \$ 12.44 13. 17.19 0. 0. B. DIST \$ .00 0. 0. 17,12 \$ ٠0. \$ .00 0. C. RESID 1518. 16.15 94. \$ D. NAT G \$ 23. 4.08 0. 13.92 \$ 0. E. COAL \$ .00 0. 3326. \$ 256. F. TOTAL 36. NON ENERGY SAVINGS(+) / COST(-) 0. \$ A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 11.65 0. \$ (2) DISCOUNTED SAVING/COST (3A X 3A1) 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4) D. PROJECT NON ENERGY QUALIFICATION TEST (1) 25% MAX NON ENERGY CALC (2F5 X .33) 1098. A IF 3D1 IS = OR > 3C GO TO ITEM 4 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= C IF 3D1B IS = > 1 GO TO ITEM 4 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY 256. 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 3326. \$ 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) 1.66 6. DISCOUNTED SAVINGS RATIO (SIR)=(5/1F)=(IF < 1 PROJECT DOES NOT QUALIFY)

SPB=1F/4

7. SIMPLE PAYBACK PERIOD (ESTIMATED)



7.84

CONSTRUCTION COST ESTIMATE	DATE PR	EPARED	SHEET OF				
PROJECT				4/2/90 1 1 8 BASIS FOR ESTIMATE			
USDB ENERGY STUDY COCATION FORT LEAVENWORTH, KS					CODE B	(PRELIMINAR	COMPLETED) Y DESIGN)
ARCHITECT/ENGINEER  CLARK RICHARDSON & BISK	UP				CODE C	(FINAL DESIG	
DRAWING NO.		ESTIMA	ATOR	DLS		CHECKED B	Y TOL
NONE ECO-A6		NTITY		ATERIAL		ABOR	TOTAL
SOLAR WINDOW SHADING	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
BUILDING 450							
SOLAR FILM	488	SQ FT	1.30	634	1.30	634	\$1,26
MOBILIZATION	488	SQ FT			0.15	73	\$7
	·						
			<u> </u>				
							:
					·		
SUBTOTAL				\$634		\$708	
CONTINGENCY 10%			10%	\$63	10%	\$71	\$13
SUBTOTAL				\$697		\$779	\$1,47
WORK COMP, TAX, SOC. SEC., INS			3.50%	\$24	13.0%	\$101	\$12
DIRECT COST				\$721		\$880	\$1,60
OVERHEAD AND PROFIT			25%	\$180	25%	\$220	\$40
SUBTOTAL				\$901		\$1,100	
CONSTRUCTION COST ENG. FORM 150		<u> </u>	<u> </u>				\$2,00

ENG. FORM 1AVC-59



# ECO-E1

LIGHTING LEVELS

	CALCULATION SHEET	DATE - Mar-90	SHEET OF
PROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	BASIS FOR CALCU	JLATION
LUCATION	FORT LEAVENWORTH, KS	COMP	RACTOR BID
ARCHITECT/E	CLARK RICHARDSON & BISKUP	COMPUTED BY	CHECKED BY
ECO MEASUR	E	DJG	MAW

BASED ON THE FOLLOWING INFORMATION:

\$200.62 FOR TYPICAL MOTION SENSOR INSTALLATION

\$0.0425 PER KWH ELECTRICITY COST 11.16 25-YEAR DISCOUNT FACTOR

BUILDING #	LIGHTING WATTS	ANNUAL NORMAL HOURS	ANNUAL HOURS SAVED	ANNUAL KWH SAVED	ANNUAL SAVINGS	PAYBACK IN YEARS	SIR
150	1280	2080	624	799	\$33.96	5.9	1.9
CONFERENCE ROOM	640	2080	624	399	\$16.96	11.8	0.9
CONFERENCE ROOM	1620	2080	624	1011	\$42.97	4.7	2.4
CHAPEL .	480	2080 -	624	300	\$12.75	15.7	0.7
CONFERENCE ROOM	1500	2080	624	936	\$39.78	5.0	2.2
CHAPEL	800	2080	624	499	\$21.21	9.5	1.2
APEL	5200	2080	624	3245	\$137.91	8.7	1.3

		DATE	SHEET OF
	CALCULATION SHEET	Oct-90	1 1
	-	BASIS FOR CALCU	ILATION
ROJECT	USDB ENERGY SAVINGS OPPORTUNITY SURVEY	X HAND	
LUJATION		COMPU	TER
1	FORT LEAVENWORTH, KS	CONTRA	ACTOR BID
ARCHITECT/E	NGINEER CLARK RICHARDSON & BISKUP		R (SPECIFY)  CHECKED BY
ECO MEASUR		COMPUTED BY DJG	MAW
ECO MEASON	F00 F1	000	

AVERAGE PAYBACK TIME FOR REPLACING EXISTING SWITCHES WITH INFRARED MOTION SENSORS FOR VARIOUS SPACES

ALL COSTS ARE BASED ON MEANS CONSTRUCTION/DEMOLITION COST DATA ELECTRICITY COST FOR FORT LEAVENWORTH USDB IS \$0.0425 PER KWH

MOTION SENSOR INSTALLATION COST

\$2.66 DEMO EXISTING SWITCH BOX \$5.76 DEMO 8' EMT WITH WIRING \$53.60 INSTALL 20', 3/4" EMT \$13.60 INSTALL 40', #12 CONDUCTORS \$125.00 INSTALL MOTION SENSOR S200.62 TOTAL COST PER INSTALLATION

POSSIBLE ENERGY SAVINGS FOR TYPICAL CONFERENCE ROOM 720 WATTS

LIGHTING LOAD **2080 HOURS** ANNUAL LIGHTING TIME \$63.65 NNUAL COST @ \$0.0425 PER KWH ANNUAL SAVINGS IF LIGHTS ARE OFF 30% OF TIME \$19.10 \$200.62 COST OF INSTALLATION 10.5 YEARS PAYBACK TIME

POSSIBLE ENERGY SAVINGS FOR TYPICAL SMALL OFFICE ROOM

320 WATTS LIGHTING LOAD **2080 HOURS** ANNUAL LIGHTING TIME \$28.29 ANNUAL COST @ \$0.0425 PER KWH ANNUAL SAVINGS IF LIGHTS ARE OFF 25% OF TIME \$7.07 \$200.62 COST OF INSTALLATION **28.4 YEARS** PAYBACK TIME

NOTE: SAVINGS ARE VERY DEPENDENT ON SEVERAL ITEMS, WHICH INCLUDE THE FOLLOWING: 1) CURRENT PRACTICES IN SWITCHING LIGHTS OFF. IF PEOPLE NORMALLY TURN LIGHTS OFF WHEN NOT

IN USE, ENERGY SAVINGS WILL BE MINIMAL.

2) AMOUNT OF TIME THAT LIGHTS WILL NOT BE IN USE. THE ABOVE ESTIMATES MAY VARY AND ACTUAL SAVINGS WILL FLUCTUATE ACCORDINGLY.

PR FIS	ENER STALLATION & OJECT NO. & T CAL YEAR 199 ALYSIS DATE:	GY CO LOCAT FITLE: 90	NSERVAT TION: FOF 1496 DIS	CRETE PORT	MENT PE ORTH - TON NA	OGRAM (E USDB RE ME: ECOE	GION N 1	OS. 7	L	OY: USDBAE CCID 1.035 CENSUS: 2
			0-30	LOCITOMIO	L					
1.	INVESTMENT A. CONSTRUCT B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	CTION OST CREDIT VALUE	CALC (1/						\$\$\$\$\$\$	802. 48. 44. 805. 0. 805.
2.	ENERGY SAV ANALYSIS DA	INGS ( TE AN	+) / COST NUAL SAV	(-) INGS, UNIT C	OST & I	DISCOUNTE	ED SAV	INGS		
	FUEL		IIT COST MBTU(1)	SAVINGS MBTU/YR(2		NNUAL \$ AVINGS(3)		COUNT CTOR(4)		ISCOUNTED AVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	***	12.44 .00 .00 4.08 .00	11. 0. 0. 0. 0.	\$ \$ \$ \$ \$ \$ \$	137. 0. 0. 0.		11.16 17.19 17.12 16.15 13.92		1529. 0. 0. 0. 0.
)	F. TOTAL			11.	\$	137.			\$	1529.
3.	NON ENERGY	/ SAVI	NGS(+) / C	OST(-)						
	A. ANNUAL F	RECUR	RING (+/-)			11.65			\$	0.
	(1) DISCO (2) DISCO	UNT F	ACTOR (T. D SAVING/	ABLE A) COST (3A X	3A1)	11.00			\$	0.
	C. TOTAL NO	N ENE	ERGY DISC	OUNTED SA	VINGS(+	.) /COST(-)	(3A2+3	Bd4)	\$	0.
	A IF 3D B IF 3D C IF 3	IAX NC 01 IS = 01 IS < D1B IS	OR > 3C C 3C CALC 3C CALC 5 = > 1 GO	UALIFICATIO Y CALC (2F5 30 TO ITEM 4 SIR = (2F5+ TO ITEM 4 ECT DOES NO	X .33) 3D1)/1F)	=	\$	505.		
4.	FIRST YEAR	DOLLA	AR SAVING	S 2F3+3A+(3I	B1D/(YE	ARS ECON	OMIC L	IFE))	\$	137.
	TOTAL NET								\$	1529.
6.	DISCOUNTED	D SAVI	NGS RATIO	O QUALIFY)	(	SIR)=(5 / 1F	<del>-</del> )=	1.90	,	
7.	SIMPLE PAY	BACK	PERIOD (E	STIMATED)	SPB=1	F/4		5.88		





STUDY: USDBAE LIFE CYCLE COST ANALYSIS SUMMARY LCCID 1.035 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) CENSUS: 2 INSTALLATION & LOCATION: FORT LEAVENWORTH - USDB REGION NOS. 7 PROJECT NO. & TITLE: 1496 DISCRETE PORTION NAME: GROUP #6 FISCAL YEAR 1990 PREPARED BY: CRB **ECONOMIC LIFE 15 YEARS** ANALYSIS DATE: 12-5-90 1. INVESTMENT 2214. A. CONSTRUCTION COST 133. \$ B. SIOH 122. \$ C. DESIGN COST 2222. D. ENERGY CREDIT CALC (1A+1B+1C)X.9 0. E. SALVAGE VALUE COST 2222. F. TOTAL INVESTMENT (1D-1E) 2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS DISCOUNTED DISCOUNT ANNUAL \$ UNIT COST SAVINGS SAVINGS(5) FACTOR(4) SAVINGS(3) **FUEL** \$/MBTU(1) MBTU/YR(2) 1729. 8.69 199. A. ELECT 16. 12.44 12.42 0. 0. \$ 0. B. DIST \$ .00 0. 12.21 0. .00 0. C. RESID \$ 1097. 11.67 94. 23. D. NAT G \$ 4.08 0. 10.36 0. 0. \$ E. COAL .00 2826. 293. F. TOTAL 39. 3. NON ENERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) 9.11 (1) DISCOUNT FACTOR (TABLE A) 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3Bd4) D. PROJECT NON ENERGY QUALIFICATION TEST 933. (1) 25% MAX NON ENERGY CALC (2F5 X .33) A IF 3D1 IS = OR > 3C GO TO ITEM 4 B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= C IF 3D1B IS = > 1 GO TO ITEM 4 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY 293. \$ 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) 2826. 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) 1.27 (SIR)=(5/1F)=6. DISCOUNTED SAVINGS RATIO (IF < 1 PROJECT DOES NOT QUALIFY)

SPB=1F/4



7. SIMPLE PAYBACK PERIOD (ESTIMATED)

7.58

BLAR - FORWARD TO KEYPUNCH AFTE COMPLETION OF "FORWARD FC ☐ DIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB. TELEPHONE will continue to experience large solar loads in the cooling season. Failure to install motion sensors could result in continued waste of lighting energy because of lights being left on during unoccupied times. SOURCE OF FUNDS If the windows remain untinted, spaces in building 450 SUFFIX BUILDING/FACILITY **BUILDING/FACILITY** NUMBER PERSON TO CALL FOR ADDITIONAL INFORMATION NUMBER DATE SUFFIX のおをほん BUILDING/FACILITY DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED alBiulildiginigt 14,510; iRieip la il irisi i i i i i WHITE (ORIGINAL) - PROJECT FILE COPY PINK OF "APPROVAL ACTION" BLOCK APPROVED FOR DESIGN ORGANIZATION NUMBER SIGNATURE SUFFIX BUILDING/FACILITY FACILITIES ENGINEERING WORK REQUEST - XFA, XFB, XFC

For use of this form, see AR 420-17 and DA Pam 420-5; the proponent agency is the Office of the Chief of Engineers.

DATE SHORT JOB DESCRIPTION NUMBER REMARKS SUFFIX BUILDING/FACILITY DESIGN ESTIMATOR MO CA MO DA FACILITIES ENGINEER PORWARDED TO NAME NUMBER DATE 450. This will reduce the solar heat gain, resulting in cooling energy savings. Install motion sensors in building 450. This will save energy Add solar shading film to the south, east and west windows in building MORI SUFFIX SIGNATURE OF APPROVAL AUTHORITY □ SELF—HELP
□ CONTRACT
□ TROOP BUILDINGFACILITY WORK TO 36 PERFORMED - IN-HOUSE OTHER FUND CITATION -GROUP 6 - PAGE 9 TELEPHONE NO. SIGNATURE NUMBER s 2,334 106 ESTIMATED COST SUFFIX BUILDING/FACILITY CAPCADED by turning lights off during unoccupied times. FUNDED TOTAL FORWARD FOR APPROVAL WO W WC L ď NO. 9,10,13,1 NUMBER EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED. APPROVAL ACTION Š REQUESTER INFORMATION CONSIDERATIONS CONSIDERATIONS 15 15 17 18 ď ENVIRONMENTAL INPACT DATE Z Z COMPLETED C EIS/EIA Š SCRIPTION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED SUFFIX SUFFIX BUILDING/FACILITY BUILDING/FACILITY O - DISAPPROVED ACTION TAKEN P 10 14 15 10 17 ORGANIZATION A - APPROVED 9 Ø NUMBER Ø 図 NUMBER C APPROVAL
OISAPPROVAL RECOMMENDED ACTION LYPE TYPE DOCUMENT NUMBER Y DOCUMENT NUMBER 7 8 9 10 11 12 13 ٠٨٠ AbE DOCUMENT NUMBER SERIAL ' NUMBER SERIAL NUMBER SERIAL PROVING AUTHORITY 4283 25.0 ag o 0.00 DNAH ci u. TRANS 2 3 O O A I RANS 3005

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## **GROUP 7**

### ENERGY CONSERVATION ANALYSIS ESOS

PROJECT GROUP	ECCO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 7 Energy Efficient Motors						
All Buildings in the USDB	ECO-E3	248 248		\$22,185 \$22,185	6.81 6.81	1,64 1,64



# ECO-E3

ENERGY EFFICIENT MOTORS





#### AVERAGE EFFICIENCIES AND ENERGY SAVINGS FOR VARIOUS MOTOR SIZES STANDARD VS HIGH EFFICIENCY PAYBACKS FOR REPLACING AN EXISTING MOTOR

		10,555	STANDARD	HI EFF	WATT	INSTALLED
HORSE-	STANDARD	HIEFF	MOTOR	MOTOR	LOSS	HIEFF MTR
POWER	MOTOR	MOTOR		WATT LOSS	DIFFERENCE	COST
	EFFICIENCY	EFFICIENCY	WATTLOSS	142	87	\$420
1	76.5	84.0	229			\$442
1.5	78.5	85.5	306	190	117	
2	80.8	86.5	355	233	122	\$466
3	79.9		563	291	272	\$582
		89.5	759	438	321	\$644
5	83.1				474	\$820 .
7.5	83.8				506	\$966
. 10	85.0				734	
15	86.5	91.7	1746			
20	87.5	93.0	2131	1123		
25			2543	1404	1139	
		93.0		1685	1338	\$2,030
30						\$2,623.
40				2339		
50	90.4	94.1	3961	2339	1022	

		8760	HOURS	5000 HOURS					
HORSE- POWER	ENERGY	COST	SIMPLE PAYBACK	SIR	ENERGY SAVINGS	COST SAVINGS	SIMPLE PAYBACK	SIR	
1	SAVINGS 763	SAVINGS \$32	13.0	0.9	435	\$19	22.7	0.5	
1.5	1,022	\$43	10.2	1.1	584	\$25 \$26	17.8	0.6	
2	1,066	\$45	10.3 5.7	1.1	1,361	\$58	10.1	1.1	
3 5	2,384	\$101 \$119	5.4	2.0	1,605	\$68	9.4	1.2	
7.5	4,150	\$176	4.6	2.4	2,369 2,530	\$101 \$108	9.0	1.2	
10	4,432	\$188 \$273	5.1 4.6	2.2	3,668	\$156	8.1	1.4	
15	6,426 8,834	\$375	4.1	2.7	5,042	\$214	7.1	1.5	
25	9,981	\$424	4.2	2.6 2.7	5,697 6,692	\$242 \$284	7.4	1.5	
30	11,725 13,120	\$498 \$558	4.1	2.7	7,489	\$318	8.2	1.3	
50			5.4	2.1	8,112	\$345	9.4	1.2	

		4380	HOURS	2920 HOURS					
HORSE- POWER	TER ENERGY COST SIMPLE SIR		SIR	ENERGY SAVINGS	COST SAVINGS	SIMPLE PAYBACK	SIR		
- 1	SAVINGS 381	SAVINGS \$16	PAYBACK 25.9	0.4	254	\$11	38.9	0.	
1.5	511	\$22	20.3	0.5	341	\$14	30.5	0	
2	533	\$23	20.6	0.5	355	\$15	30.9	0	
3	1,192	\$51	11.5	1.0	795	\$34	17.2	0	
5	1,406	\$60	10.8	1.0	937	\$40	16.2		
7.5	2,075	\$88	9.3	1.2	1,383	\$59	13.9	- 0	
10	2,216	\$94	10.3	1.1	1,477	\$63	15.4		
15		\$137	9.2	1.2	2,142	\$91	13.8		
20		\$188	8.1	1.4	2,945	\$125	12.2	. (	
25		\$212	8.4	1.3		\$141	12.2		
30		\$249	8.1	1.4		\$166	14.1		
40		\$279	9.4	1.2	4,373	\$186	16.1		
50		\$302	10.7	1.0	4,737	\$201	10.1		

ELECTRICITY COST = 4.25¢/KWH

	CALCULAT	DATE Mar-90		SHEET 1	2					
PROJECT	USDB				BASIS FOR CALCULATION					
	ENERGY SA	AVINGS OF	PPORTUNIT	Y SURVEY	X HAND					
OCATION	FORT LEAV	ENWORTH	1, KS		COMPUTER CONTRACTOR BID					
RCHITECT/E	NGINEER					OTHER (SP	ECIFY)			
	CLARK RIC	<u>HARDSON</u>	& BISKUP		COMPUTED		CHECK			
CO MEASUR	ECO-E3					DJG		MAW		
			0050	SAVINGS	SAVINGS	INSTALLED	SIR	PAYBAC		
UILDING # A		HP	OPER. HOURS/	PER YEAR	PER YEAR	COST		YEARS		
IOTOR DESC	ATTIC TON		YEAR	MBTU'S	DOLLARS	\$442	0.5	20.9		
UILDING 463		1.5	4380	1.7	\$21.15	<b>\$442</b>	0.5	20.0		
AN JUILDING 463		5	4380	4.8	\$59.71	\$644	1.0	10.8		
ONDENSING			4000				0.5	20.9		
<b>UILDING</b> 464		1.5	4380	1.7	\$21.15	\$442	0.5			
AN BUILDING 464		1.5	4380	1.7	\$21.15	\$442	0.5	20.9		
AN					\$68.42	\$644	1.2	9.4		
UILDING 465		5	5000	5.5	900.42	ΨΟ 1 .				
OMPRESSO BUILDING 465		5	5000	5.5	\$68.42	\$644	1.2	9.4		
COMPRESSO	R		1200	1.7	\$21.15·	\$442	0.5	20.9		
OLD WATER		1.5	4380 ·	1.7	\$21.15			- 00		
BUILDING 465		7.5	4380	7.1	\$88.32	\$820	1.2	9.3		
OT WATER	PUMP		4000	1.8	\$22.39	\$466	0.5	20.8		
BUILDING 465 IR HANDLIN		2	4380	1.0	ψ <u>2</u> 2.00			06.0		
BUILDING 465		1	4380	1.3	\$16.17	\$420	0.4	26.0		
AIR HANDLIN			4380	1.3	\$16.17	\$420	0.4	26.0		
BUILDING 469 AIR HANDLIN			4300	1.0			10	11.4		
BUILDING 472	2	3	4380	4.1	\$51.00	\$582	1.0	11.4		
OT WATER	PUMP	1.5	4380	1.7	\$21.15	\$442	0.5	20.9		
BUILDING 472 AN	2	1.5	4300	1.7			1	11.4		
BUILDING 473	3	3	4380	4.1	\$51.00	\$582	1.0	11.4		
HOT WATER	PUMP	5	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 473 HOT WATER		3	4000			#0.000	2.4	4.7		
BUILDING 474	4	40	8760	44.8	\$557.31	\$2,623	2.4			
BOILER FEED BUILDING 47		10	8760	15.1	\$187.84	\$966	2.2	5.1		
FAN					2107.04	\$966	2.2	5.1		
BUILDING 47	4	10	8760	15.1	\$187.84	2900	2.6			
FAN BUILDING 47	4	10	8760	15.1	\$187.84	\$966	2.2	5.1		
FAN			0760	15.1	\$187.84	\$966	2.2	5.1		
BUILDING 47 CONDENSAT		10	8760	15.1				5.1		
BUILDING 47		10	8760	15.1	\$187.84	\$966	2.2	5.1		
CONDENSAT	E PUMP		0760	8.1	\$100.76	\$582	1.9	5.8		
BUILDING 47 AIR COMPRE		3	8760	0.1			1-=-	4.2		
<b>BUILDING 47</b>	4	25	8760	34.1	\$424.20	\$1,780	2.7	4.2		
AIR COMPRE	SSOR		1							

				DATE		SHEET			
CALCULATION S	HEEI			Mar-90	-	2	- 2		
				BASIS FOR CALCULATION					
PROJECT USDB		DTUNUTY C	IDVEV						
ENERGY SAVING	SOPPO	RIGNITIO	J114L1	x	HAND				
CATION	00711 1/	_			COMPUTER				
FORT LEAVENW	OHIH, K		CONTRACTOR	BID					
ARCHITECT/ENGINEER		OTHER (SP	ECIFY)						
CLARK RICHARD	SON & B	ISKUP		COMPUTED E	3Y	CHECK	ED BY		
ECO MEASURE					DJG		MAW		
ECO-E3									
	Lun	OPER.	SAVINGS	SAVINGS	INSTALLED	SIR	PAYBACK		
BUILDING # AND	HP	HOURS/	PER YEAR	PER YEAR	COST		YEARS		
MOTOR DESCRIPTION		YEAR	MBTU'S	DOLLARS					
	<del> </del>	4380	4.1	\$51.00	\$582	1.0	11.4		
BUILDING 475	3	4300	7.1						
ROTUNDA CONDENSING UNIT	1-75	4380	7.1	\$88.32	\$820	1.2	9.3		
BUILDING 475	7.5	4300	1				100		
ROTUNDA CONDENSING UNIT	<del> </del>	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 475C	5	4300	7.0	7					
FAN	+	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 475C	5	4300	7.0						
FAN	<del> </del>	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 475D	5	4300	7.0						
FAN	<del> </del>	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 475D	5	4300	7.0						
FAN	<del> </del>	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 475F	5	4360	7.0				10.0		
FAN .	5	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 475F	٥	4300	7.0						
FAN	5	4380	4.8	\$59.71	\$644	1.0	10.8		
BUILDING 475G	) 5	4300	1 7.0						
AN		4380	4.8	\$59.71	\$644	1.0	10.8		
JUILDING 475G	5	4300	7.5						
FAN			248	\$3,085.00	\$20,929	1.6	6.8		
TOTAL			2.0	1	1	1	1		
(SIR > 1)									

INS	ENER & TALLATION:   DJECT NO.	GY C	ONSERVAT ATION: FOF		MENT PR ORTH -	OGRAM (E USDB RE	GION NO.	s. 7		IDY: USDBAE LCCID 1.035 CENSUS: 2
EIC	CAL YEAR 199 ALYSIS DATE:	an n	DIS	CRETE PORT ECONOMIC	ION NAM	ME: GROU YEARS	P #7 PREP	ARED	BY: C	RB
	INVESTMENT A. CONSTRUI B. SIOH C. DESIGN CO D. ENERGY CO E. SALVAGE F. TOTAL INV	CTIO OST CRED VALL	IT CALC (1/						***	20929. 1256. 1151. 21002. 0. 21002.
2.	ENERGY SAV ANALYSIS DA	INGS	(+) / COST NNUAL SAV	(-) INGS, UNIT C	OST & D	SCOUNT	ED SAVIN	GS		
	FUEL		INIT COST /MBTU(1)			NNUAL \$ AVINGS(3)		OR(4)		DISCOUNTED SAVINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	12.44 .00 .00 4.08 .00	248. 0. 0. 0. 0.	\$ 5 5 5 5	3085. 0. 0. 0.		11.16 17.19 17.12 16.15 13.92		34429. 0. 0. 0. 0.
Ì	F. TOTAL			248.	\$	3085.			\$	34429.
3.	NON ENERGY	Y SA\	/INGS(+) / C	OST(-)						_
	A. ANNUAL F	TAU	FACTOR (T	ABLE A)		9.11			\$	0. 0.
	(2) DISCO	TNU	ED SAVING/	COST (3A X					\$	0.
	C. TOTAL NO	ON EN	NERGY DISC	OUNTED SA	VINGS(+)	/COST(-)	(3A2+3B0	14)	\$	0.
	A IF 30 B IF 30 C IF 3	IAX N D1 IS D1 IS D1B	ION ENERG = OR > 3C G < 3C CALC IS = > 1 GO	Y CALC (2F5 30 TO ITEM 4   SIR = (2F5+	X .33) 3D1)/1F):		\$ 1	1362.		
4.	FIRST YEAR	DOLI	AR SAVING	S 2F3+3A+(3	B1D/(YE/	ARS ECON	OMIC LIF	E))	\$	3085.
5.	TOTAL NET	OISCO	OUNTED SA	VINGS (2F5+	3C)				\$	34429.
6.	DISCOUNTED	D SAY	VINGS RATIO	O QUALIFY)	(S	SIR)=(5 / 1F	-)=	1.64		
7.	SIMPLE PAY	BACK	( PERIOD (E	STIMATED)	SPB=1F	=/4		6.81		

ż COMPLETION OF "FORWARD F. こいのおとさいます] ☐ OIRECT ☐ AUTOMATIC REIMB. ☐ FUNDED REIMB. SOURCE OF FUNDS SUFFIX שחור מואט/באכורו בל SUFFIX υ **BUILDING/FACILITY** Energy will continue to be wasted by operation NUMBER PERSON TO CALL FOR ADDITIONAL INFORMATION NUMBER SUFFIX SUILDING/FACILITY といめたり DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED NUMBER そのことでいっていいはの APPROVED FOR DESIGN AIBIN & ITION P IB 値 file ibie init i - IMIO itio ITI Si WHITE (ORIGINAL) - PROJECT FILE COPY BY THE COMPLETION PINK

PINK

STORY OF TAPPROVAE ACTION'S LOCK standard efficiency motors SUPERX FACILITIES ENGINEERING WORK REQUEST - XFA XFS, XFC ASN For use of this form, see AR 420-17 and DA Pam 420-5; the propoperent agency is the Office of the Chiefol Engineers. SIGNATURE BUILDING/FACILITY SHORT JOB DESCRIPTION 24:24 467 38 111 26 NUMBER REMARKS SURFIX BUILDING/FACICITY DESIGN ESTIMATOR PACILITIES ENGINEERS FORWARDED TO カンイン 37.40 RESENON Nebrace existing standard efficiency motors with high efficiency motors, where economically feasible. Use energy efficient motors when replacing notors during regular maintenance. This will result in higher complex lower factors at the USDB and less electrical energy consumption. MORE SUPPLX BUILDINGFACILITY SIGNATURE OF APPROVAL AUTHORITY C SELF-HELP CONTRACT TROOP WORK TO SE OTHER FUND CITATION GROUP 7 - PAGE 6 TELEPHONE NO. SIGNATURE NUMBER \$ 22,185 \$ 23,193 ESTIMATED COST SUFFIX BUILDING/FACILITY ひょりとりょくり ひゅつどつに 9 10721 9 11 0 11 3 11 FORWARD FOR APPROVAL xl V NUMBER, DATE APPROVAL ACTION EDITION OF 1 FEB 18 WILL BE USED UNTIL EXHAUSTED. Š REQUESTER INFORMATION ENVIRONMENTAL INPACT C ENVIRONMENTAL χ. OA 15 16 17 18 DATE EIS/EIA COMPLETED C EIS/EIA TION AND JUSTIFICATION OF WORK TO BE ACCOMPLISHED ž SUFFIX SUPPIX BUILDING/FACILITY BUILDING/FACILITY 0 - 015APPROVED POSDBILL U ORCANIZATION ACTION TAKEN A - APPROVED NUMBER いことのという Ö [3] Ø EJ C APPROVAL RECOMMENDED ACTION DOCUMENT NUMBER ٨, DOCUMENT NUMBER 41 8 19 10 11 12 12 13 14 ٠٨: TYPE SERIAL ' NUMBER .. SERIAL NUMBER DOCUMENT NUMBER SERIAL とこれのよいしい ひ 10 ละด 4283 038 õ DNAIL CHÁNGE U ne I'v S m